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American Foundryman

A PUBLICATION PRESENTING ASSOCIATION ACTIVITIES

October
1944

Membership in A.F.A. Is a Means of Building Morale Among Employees

RECENTLY in talking with a group of foremen and supervisors in the foundry industry, all of whom are members of the American Foundrymen's Association, the thought was expressed that they individually valued their membership so much in the A.F.A. that they would continue to maintain their memberships for the duration of their connection with the foundry industry.

A further thought was expressed that, while the individual benefits to the degree as stated above, the companies where they are employed benefited to a much greater degree.

These men were very frank in stating that they thought a company which pursued a policy of *not* maintaining a membership in the American Foundrymen's Association, thereby making it possible for its employees to carry associate memberships, was very shortsighted. They were of the opinion that such a company probably was pursuing just as shortsighted policies in various other matters which would ultimately influence the employee to seek employment with a more progressive firm. They also believed that it is a good policy for employees to endeavor to become associated with those organizations which pursued more liberal operating policies.

It is evident from the foregoing consensus of opinion that one of the advantages of company membership in the A.F.A. is the building of morale and loyalty in the personnel through establishing confidence in company policies. This is especially true among those employees who are now holding key positions or who, through keeping abreast of the latest developments in technical matters, are prospective key employees.

I. R. Wagner

I. R. WAGNER, *Director*
American Foundrymen's Association

I. R. Wagner, President, Electric Steel Castings Co., Indianapolis, Ind., is a director of the American Foundrymen's Association and a member of the Executive Committee. He previously served the Association as Chairman of the Central Indiana Chapter and as a member of a number of committees in the Steel Division. In addition to his A.F.A. activities, Mr. Wagner is active in the affairs of the Steel Founders' Society of America.

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American Foundryman

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CHAPTER CONTACT CONFERENCE
at First Annual Meeting
HELPS TO COORDINATE ACTIVITIES

TWENTY-SEVEN officers of the A.F.A. Chapters gathered in Chicago, August 26, with several National Officers and Directors and members of the Headquarters Staff, for the 1st annual Chapter Contact Conference of the Association. Called for the purpose of establishing closer relations between the national organization and the local groups, so as to coordinate activities on behalf of the entire industry, the conference proved to be, in the words of one Chapter chairman attending: "The finest and most constructive meeting that I have ever attended connected with A.F.A. or otherwise."

National Director I. R. Wagner, Electric Steel Castings Co., Indianapolis, Ind., as chairman of the Chapter Contacts Committee of the A.F.A. Board, acted as presiding chairman at the meeting. Other National Officers who attended:

A.F.A. President, Ralph J. Teetor, Cadillac Malleable Iron Co., Cadillac, Mich.

A.F.A. Vice-President, F. J. Walls, International Nickel Co., Detroit.

Director S. V. Wood, Minneapolis Electric Steel Castings Co., Minneapolis.

Director W. B. Wallis, Pittsburgh Lectromelt Furnace Corp., Pittsburgh, Pa.

25 Chapters Represented

Of the 25 Chapters and one Chapter section represented at the conference, 22 were represented by their Chairmen, two by their Vice-Chairmen, and two by the Secretary. This splendid representation, in spite of the fact that the meeting was held during the vacation period of the summer, accounts in large part for the successful meeting. Chapter officers who attended were:

Birmingham—Secretary-Treasurer F. K. Brown, Adams Rowe & Norman, Inc., Birmingham, Ala.

Canton — Chairman K. F. Schmidt, United Engineering & Foundry Co., Canton, Ohio.

Central Indiana—Chairman H. H. Lurie, Cummins Engine Co., Columbus, Ind.

Chesapeake—Chairman H. A. Horner, Frick Co., Waynesboro, Pa.

Chicago—Chairman A. S. Klopf, Firegan Sales Co., Chicago.

Cincinnati—Chairman W. A. Rengering, Cincinnati Milling Machine Co., Cincinnati.

Detroit — Chairman R. G. McElwee, Vanadium Corp. of America, Detroit.

Eastern Canada & Newfoundland—Vice-Chairman G. Ewing Tait, Dominion Engineering Works, Lachine, Quebec.

Metropolitan—Represented by F. G. Sefing, International Nickel Co.

Michiana — Chairman V. C. Bruce, Buckeye Products Co., Elkhart, Ind.

Northeastern Ohio—President R. F. Lincoln, R. F. Lincoln Co., Cleveland.

Northern California — President R. C. Noah, San Francisco Iron Foundry, San Francisco.

Northern Illinois & Southern Wisconsin —Chairman R. W. Mattison, Mattison Machine Works, Rockford, Ill.

Ontario — Chairman R. T. Robertson, International Harvester Co. of Canada, Hamilton, Ontario.

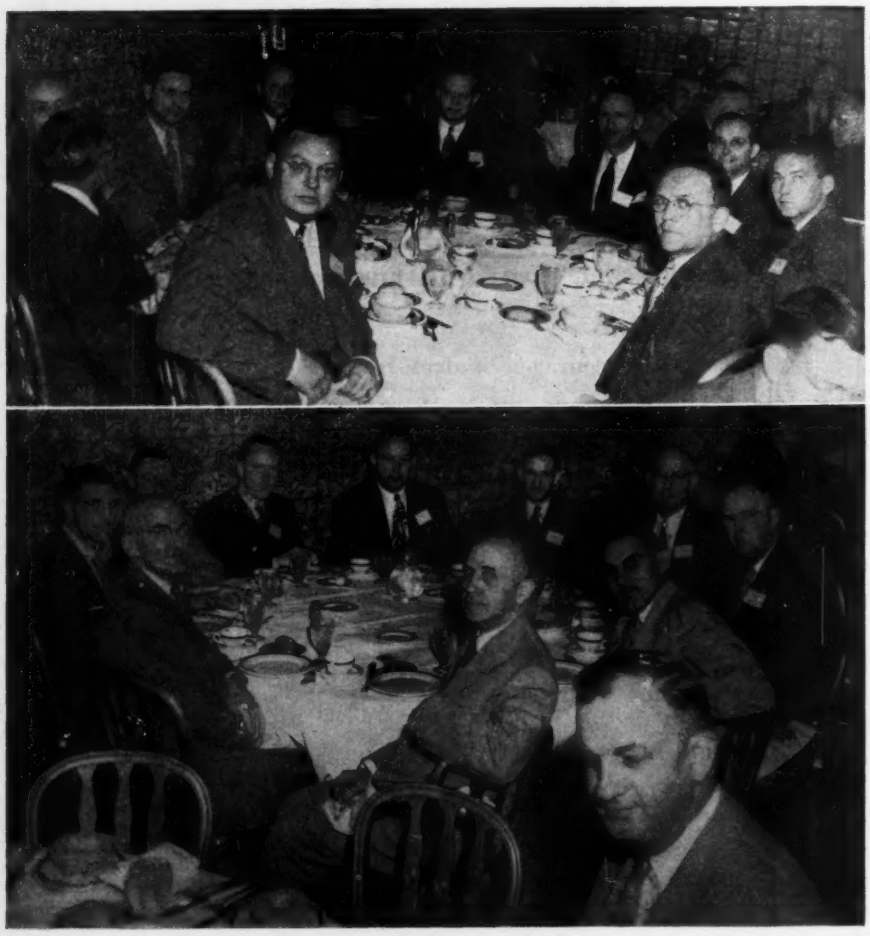
Philadelphia — Vice-Chairman J. M. Robb, Jr., Hickman Williams & Co., Philadelphia.

Quad City — Chairman R. E. Wilke, Deere & Co., Moline, Ill.

Rochester — President H. B. Hanley, American Laundry Machinery Co., Rochester, N. Y.

Saginaw Valley Sec. of Detroit—Secretary H. G. McMurry, Buick Motors Div., General Motors Corp., Flint, Mich.

St. Louis—Chairman E. E. Ballard, National Bearing Metals Corp., St. Louis.



Upper Photo (Left Foreground)—W. D. Bailey, Jr. (Left to Right around table)—Dr. Ralph L. Lee, R. G. McElwee, R. E. Wilke, H. B. Hanley, Fred J. Walls, F. G. Sefing, Leonard Larsen, R. W. Mattison and A. S. Klopf.

Lower Photo (Center Foreground, at table)—Ralph J. Teetor. (Left to Right around table)—H. A. Horner, G. Ewing Tait, K. F. Schmidt, R. T. Robertson, R. C. Noah, H. H. Lurie, E. E. Ballard, S. V. Wood and F. M. Wittlinger

Southern California — President W. D. Bailey, Jr., Westlectric Castings, Inc., Los Angeles.
Texas — Chairman F. M. Wittlinger, Texas Electric Steel Castings Co., Houston, Texas.
Toledo — Chairman Leighton M. Long, Leighton M. Long & Associates, Toledo, Ohio.
Twin City — Chairman A. M. Fulton, Northern Malleable Iron Co., St. Paul.
Western Michigan — Chairman J. L. Brooks, Muskegon Piston Ring Co., Sparta, Mich.
Western New York — Chairman R. D. Loesch, Lake Erie Foundry Co., Buffalo, N. Y.
Wisconsin — President H. E. Ladwig, Allis-Chalmers Mfg. Co., Milwaukee.

In opening the meeting, President Teetor said: "A.F.A. held its first meeting on June 12, 1896, at Philadelphia—which gives it the ripe old age of over 48 years. At that first meeting little was said about aims and objectives. It was not until 1900 that definite objectives were set down for A.F.A., but—and this is significant—those same fundamental aims, worded only a little differently now, still guide the work of A.F.A.

"One guiding principle of A.F.A. that has remained unchanged is that A.F.A. is and shall continue to be a Service organization.

"It may be of interest to recall that the A.F.A. Apprentice Training Committee offered a uniform apprentice plan to the industry as far back at 1897. It may be news to some that an A.F.A. committee, organized in 1897, developed the first standardized cast iron drillings used in foundry laboratories today for chemical analysis of iron. Those findings were turned over to the National Bureau of Standards, which now provides standard samples for nearly all types of metals.

"The first illustrated paper on the application of metallurgy to foundry work was presented at the 1902 A.F.A. meeting. The first A.F.A. paper using micrographs of cast iron appeared in 1903, and standard methods for analyzing cast iron were presented in an A.F.A. publication that same year.

"The four major activities of the Association are: Member Service, Committee Work, Publications, and Annual Meetings. Each of these activities, before it was ever undertaken, was carefully considered in the light of possible Service to the Industry.

"For example, A.F.A. had no technical divisions prior to 1929.

Upper Photo (Center Foreground)—R. J. Teetor. (Right Foreground)—H. A. Horner. (Right to Left around table)—John M. Robb, Jr., N. F. Hindle, W. W. Maloney, F. G. Steinebach, I. R. Wagner, Miss Jennie Reininga, A. M. Fulton, H. E. Ladwig and Gerald Buehler.
Lower Photo (Foreground Left to Right)—R. W. Mattison, A. S. Klopf, W. D. Bailey, Jr. (Center Foreground, rear table)—R. E. Kennedy. (Left to Right around table)—W. B. Wallis, W. A. Rengering, R. F. Lincoln, Leighton Long, V. C. Bruce, J. L. Brooks, R. D. Loesch, F. K. Brown and H. G. McMurry.

Out of the need for studies on specific types of metals grew our present six technical divisions: Gray Iron, Steel, Malleable, Brass and Bronze, Aluminum and Magnesium, and Patternmaking. The newest division, Aluminum and Magnesium, was created in 1942, fostered directly by the tremendous increase in the use of light metals for war production work.

100 A.F.A. Committees

"During the past year, over 400 men of the industry have been serving faithfully on over 100 committees of the Association, giving their valuable time and experience, unselfishly, for advancement of their chosen field. No commercial organization in the world is big enough or powerful enough to buy or command all the knowledge and experience these men give in A.F.A. committee service, without charge and freely, and often at considerable expense to themselves and their companies in time, energy and money.

"This is the kind of organization you men represent as Chairmen of your Chapters. This is the kind of men you men are."

The conference succeeded in bringing the broad picture of A.F.A. activities to the Chapter officers, with the Chapter officers contributing to the discussion from the experience of their own local groups. Among the subjects discussed were: Cooperation with engineering schools and colleges, apprentice and student activities, the technical committee work of A.F.A., methods of building chapter programs, holding of regional meetings and educational courses, interesting foundry management in the work of A.F.A., encouraging youths in foundry work, and chapter membership committee efforts.

One of the most interesting subjects involved cooperation with engineering schools and colleges, with Fred G. Sefing, International Nickel Co., New York, and chairman of the A.F.A. Committee on Cooperation with Engineering Schools and Colleges, acting as discussion leader. Mr. Sefing brought out a number of ways in which foundries can assist in the work of his committee.

Pointing out that the future of any industry depends on the men in it, he urged foundries to request their technical schools to provide courses for men already in the industry, to take more interest in

1944 Edition of Cast Metals Handbook Now Ready for Member Distribution

ALL A.F.A. members have now been notified that the 1944 edition of the Cast Metals Handbook is ready for distribution.

The new Handbook is a complete, accurate and authoritative reference book dealing exclusively with the Engineering Properties of Cast Metals. This is the 3d edition, completely revised in light of the improvements in cast metals of recent years. Cloth bound, it contains 745 pages, 258 illustrations, 204 tables, and is enclosed in a colorful, attractive book jacket.

Members of A.F.A. in good standing up to December 1, 1944, are entitled to one gratis copy of the new Cast Metals Handbook, *on request.* After December 1, by authority of the A.F.A. Board of Directors, *all free distribution of the book will be terminated.*

The Handbook was prepared sepecifically to acquaint those who design and specify metal products with the unlimited possibilities of castings. Thus the book's greatest value to the Foundry Industry can be achieved only through maximum distribution to engineers. Existing paper restrictions have reduced the size of the original printing, hence it is important to place all copies where they will be of greatest usefulness.

A.F.A. members in good standing are urged to send in requests for free copies promptly—*prior to December 1.* Orders for additional copies also are being accepted, at the member price of $4.00 each, a 33 1/3 per cent discount off the non-member list price of $6.00.

employment of engineering school graduates, and to provide a definite program of training for such men whom they employ. He also presented some suggestions offered by school faculties on how the foundry industry can create more interest in foundry work among students.

Apprentice Training

These suggestions included the following: Visits by foundrymen to the schools, lectures by prominent foundrymen before graduating classes, consulting with faculties for betterment of foundry courses, offering scholarships or fellowships at engineering schools, turning over foundry research projects to the schools for study, and contacting graduating engineers for the purpose of offering them foundry employment.

The importance of apprentice training to the industry was emphasized, and the work of A.F.A. in this respect described, as well as the efforts of a number of Chapters. R. J. Lincoln, president of Northeastern Ohio Chapter, told how they sponsor apprentice training in the Cleveland area, and the unique and comprehensive steps they have taken to interest civic and educational groups in opportunities offered boys by the industry.

Vice-Chairman G. Ewing Tait of Eastern Canada and Newfoundland Chapter described that group's cooperation with the Montreal Technical School. The Canadian chapter maintains close contact with the school authorities, sponsors plant visits, and members of the chapter assist in giving lectures.

Director S. V. Wood described the work of a new committee of the A.F.A. Board, the Management Committee, and emphasized the importance of foundry management taking a greater pride in the industry and a larger part in its advancement. One function of this committee, he said, will be to help foundry management become more conscious of the fact that a poor casting, no matter what metal it is poured in, is a reflection on all castings, since it is a reflection on all cast structures.

Vice-President Walls, as Chairman of the new Youth Encouragement Committee of the Board, said that the basic purpose of this committee will be to work toward assuring a future supply of young men for the foundry industry. He stated that it has proved advisable to go back as far as the grade schools in order to create an early interest in boys who might enter the industry, through shop visitations and the like. He urged Chapter officers to sponsor closer connections with schools.

Technical Development Program

The technical committee work of A.F.A. was completely described by N. F. Hindle, newly elected Director of the A.F.A. Technical Development Program, an activity more completely described elsewhere in this issue. Mr. Hindle outlined the technical organization of A.F.A. and the work of various active committees. He reported that special publications of the Association are:

"Modern Core Practice and Theory," by H. W. Dietert.
"Microscope in Cast Iron Metallurgy," by R. M. Allen.
"Recommended Practices for Sand Casting Non-Ferrous Alloys."
"Alloy Cast Irons Handbook."
"Magnesium Foundry Practice" (a symposium).
"Malleable Iron Melting Practice" (a symposium).
"Code of Recommended Practices for Industrial Housekeeping and Sanitation" (6th of A.F.A. codes).

He also stated that the 1944 edition of the Cast Metals Handbook now is coming off the press for immediate distribution, and that a new edition of the Sand Testing Handbook (Testing and Grading Foundry Sands and Clays) can be expected within a month or two.

Mr. Hindle urged Chapter officers to assist in the technical activities of A.F.A. by suggesting outstanding men for committee work, suggesting specific activities of benefit to the membership, and offering constructive suggestions on present technical activities.

International Relations

Featuring the luncheon session was a talk on international foundry relations by F. G. Steinebach, "The Foundry," Cleveland, as chairman of the A.F.A. Committee on International Relations. Mr. Steinebach traced the origin of exchange papers between A.F.A. and foreign foundry groups, particularly the exchange relationship with the Institute of British Foundrymen which dates back as far as 1921. He pointed out that such cooperation might well prove an important factor in postwar building of economic good will between the U. S. and foreign lands.

As a climax to the conference, Dr. Ralph L. Lee, of the public relations department of General Motors Corp., Detroit, gave a splendid talk on leadership in industry. Illustrating his talk with excerpts from his inspiring booklet called "Man to Man on the Job," he pointed out those qualities of leadership which particularly impress the men in the shop.

NEW PROGRAM

for the Expansion of Technical Activities

Approved by A.F.A. Directors

ANNOUNCEMENT has just been made of formation of a new Technical Development Program of A.F.A., for the purpose of broadening and expanding the technical activities of the Association, beyond limitations that have existed in the past. Final approval of the basic organization was given by the Board of Directors at the annual Board meeting held recently in Chicago, at which time N. F. Hindle, formerly Assistant Secretary, was appointed Director to head up the Program.

Vastly increased technical advancements in the foundry industry have indicated, for some time past, the need for closer coordination of all A.F.A. technical activities so as to more fully serve the greatly increased membership. At a Board of Directors meeting held January 13, 1944, a plan was approved for carrying out more fully the fundamental objects of the Association, namely:

1. To promote the arts and sciences applicable to metal casting manufacture.

2. To improve the methods of production and the quality of castings.

It was to carry out these objectives, more effectively than previous financial limitations made possible, that the Technical Development Program was established, with its scope defined as follows:

(1) Revising and publishing special books and publications, such as Cast Metals Handbook, Alloy Cast Irons Book, Core Book, Sand Book, and Recommended Non-Ferrous Practices Book — excepting the "American Foundryman," preprints, and the annual bound volumes.

(2) Collecting, reviewing, summarizing or correlating published and unpublished data on selected outstanding foundry problems and publishing this material as books or pamphlets.

(3) Promoting and coordinating research activities, such as Foundry Sand Research, Cupola Research, Fluidity of Cast Metals.

(4) Broadening of Library facilities for reference and abstract purposes.

(5) Providing abstract and bibliographic service to the industry.

(6) Developing of lecture material for use in chapter meetings and for engineering and other groups.

As Director of the new Program, Mr. Hindle will act under the general supervision of Secretary R. E. Kennedy, working with an Advisory Committee composed of three members of the Board of Directors and representatives from management, technical and operating groups of the various branches of the industry. The Advisory Commitee includes:

N. F. Hindle, Director
Technical Development Program

W. L. Woody, Vice-Chairman
Advisory Committee

S. V. Wood, Chairman
Advisory Committee

Chairman, S. V. Wood, President and Manager, Minneapolis Electric Steel Castings Co., Minneapolis, a National Director of A.F.A.

Vice-Chairman, Walton L. Woody, Vice-President in Charge of Operations, National Malleable & Steel Castings Co., Cleveland, National Director of A.F.A.

Max Kuniansky, Vice-President and General Manager, Lynchburg Foundry Co., Lynchburg, Va., National Director of A.F.A.

Dr. D. Basch, Consultant, General Electric Co., Schenectady, N. Y., representing the light metals.

Hyman Bornstein, Director of Laboratories, Deere & Co., Moline, Ill., representing gray iron and malleable iron.

George K. Dreher, Vice-President in Charge of Manufacturing, Ampco Metal, Inc., Milwaukee, representing brass and bronze.

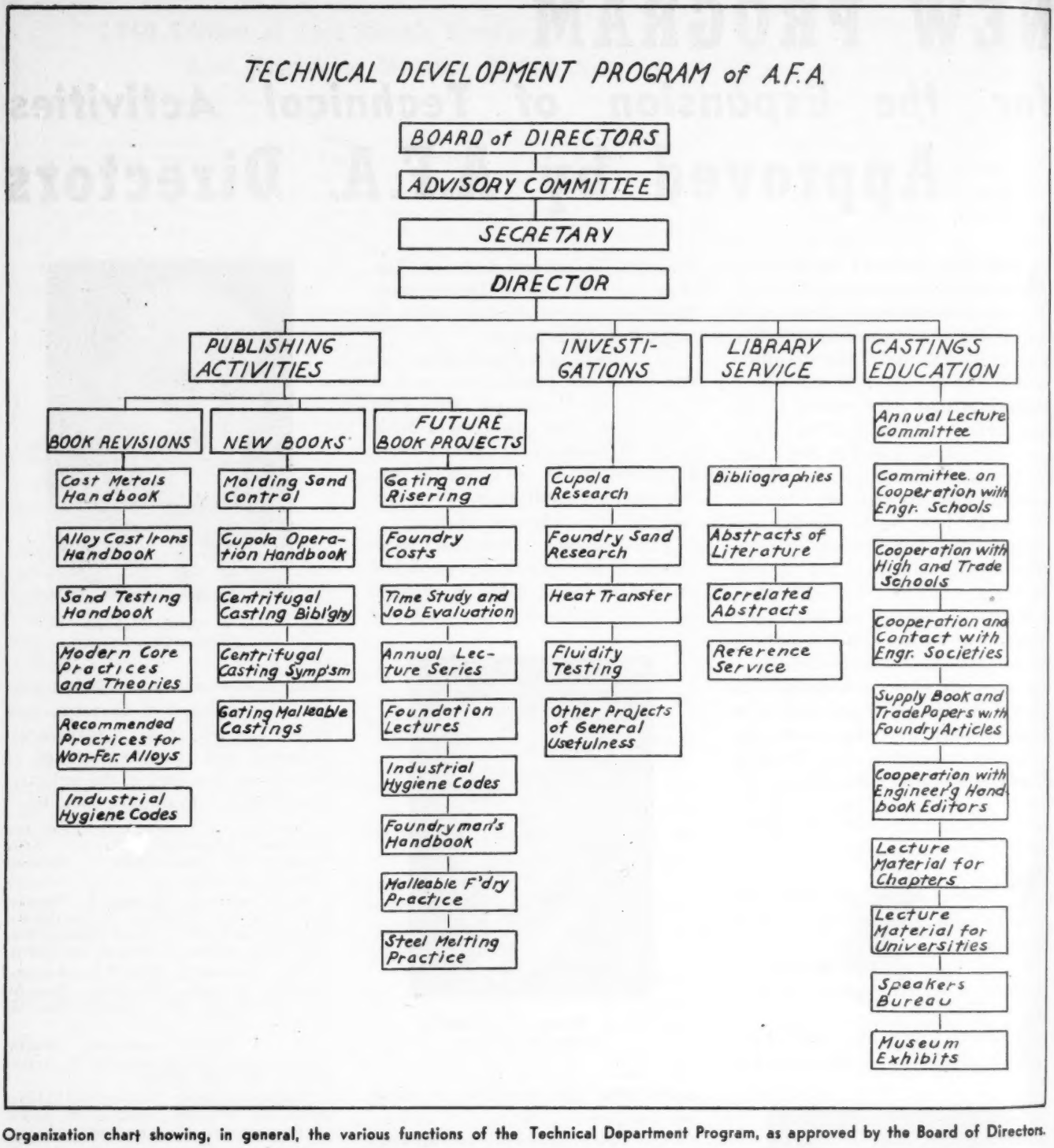
C. J. Freund, Dean of Engineering, University of Detroit, Detroit, representing educational interests.

James H. Lansing, Consulting Engineer, Malleable Founders' Society, Cleveland, representing malleable iron.

F. A. Melmoth, Vice-President in Charge of Operations, Detroit Steel Casting Co., Detroit, representing steel.

H. S. Simpson, Chairman of the Board, National Engineering Co., Chicago, representing foundry equipment manufacturers.

For initial financing of the Technical Development Program, the



Organization chart showing, in general, the various functions of the Technical Department Program, as approved by the Board of Directors.

A.F.A. Board appropriated $25,000 from the general funds of the Association previously used for those special activities which now will be carried on under the new Program. In addition, donors to the original "Foundation Promotion Fund," have been requested to make available their contributions for carrying on the Program, it being intended ultimately to establish and maintain a working fund of $100,000 to assure continuity of the work.

In the accompanying chart of the Program it will be seen that its functions will include the preparation, financing and publishing of all such special publications as the Core Book, Alloy Cast Irons Book, Non-Ferrous Practices Book, new Cast Metals Handbook and Sand Testing Handbook, etc. As the Program develops, it is expected that it will result in the publication of a considerably greater volume of technical and practical literature for the foundry industry, as well as publications having specific application to immediate needs of the various branches of metal casting.

Without exception, announcement of the Technical Development Program has been hailed by foundry leaders as one of the most forward steps ever taken by A.F.A. on behalf of the entire industry. The Program became effective July 1, 1944, with separate budgets set up for its efficient operation, and the Association looks forward to whole-hearted support by all branches of the foundry field.

PRECISION CASTINGS

Employing Dental Technique

BY INVESTMENT MOLDING PROCESS

• Part II of this article, which originally was presented at a session on centrifugal castings at the 3rd War Production Foundry Congress, Buffalo, completes the explanation of the manufacture of precision castings by the investment molding process. It describes a new type of centrifugal casting machine for multiple molds and compares the cost of precision castings with sand castings.

Presented by
ROBERT NEIMAN
Whip-Mix Corp., Louisville, Ky.

THE principal materials and equipment used by the dentist, jeweler and precision caster were given in the first instalment of this article, which appeared in the September issue of AMERICAN FOUNDRYMAN. The discussion of patterns, including the metal die also was included in Part I, up to "Die Production" which follows. To facilitate complete understanding, Fig. 8 is repeated in Part II.

Die Production (Fig. 8). A matrix or holder is made of convenient size, two pieces of steel (1 and 1′) 6x4x½ in. are cut away in the center leaving a rectangular opening (2) 4x3x½ in. They are held in relative position with pins (3) similar to flasks holding cope and drag. Part *B*, Fig. 8, shows a cross section through the center along the 6-in. dimension.

The opening in one half of the holder is filled with plastic clay (4), Part *B*, and the master pattern (5) (1.015 in.) is pushed into the clay to the desired parting line. The excess clay is trimmed away to give a fairly smooth surface.

The upper half matrix (1′) is placed on top of (1) and secured with pins (3). Fusible metal is heated to about 50° F. above its fusing point and poured quickly over the master pattern and forms the upper mold half *C* (6).

After cooling, the entire assembly is inverted, the clay (4) is removed and fusible metal is poured into the space. An excess of fusible metal is used and then planed off even with the finished die. The master is then removed and the halves put together. It should be noted that (7) *C* will form the entrance sprue of the wax.

The example shows a very simple pattern: obviously, an intricate pattern would be made in similar manner but with a die made in a number of sections, similar to an intricate sand casting made in an assembly of cores. For example, a hole may be made in the pattern by setting a pin in the die at the time it is poured. This is shown as (8) in Fig. 8, *B, C* and *D*.

Pattern Production. The metal die is assembled and lubricated with oil or special lubricants. A wax gun (9), Fig. 8 *D*, is placed over the mold and properly clamped. Wax is kept a little above its melting point by a suitable heating element wound around (9) *D*. Wax is forced into the pattern chamber by pushing piston (10) downward by means of a handle (11) pivoted at (12).

To speed up production, it is possible to put several similar cavities in a die and thus produce several wax patterns at once. The die can be mounted in an assembly so that opening and closing the die is done mechanically. Many controls, such as timing, automatic injection, etc., are included in some machines. These are almost a necessity to insure reproducible accuracy.

As soon as the pattern has solidified, the mold *D* is separated and the pattern is removed. The pattern had been adapted in a warm die, and upon cooling it will shrink.

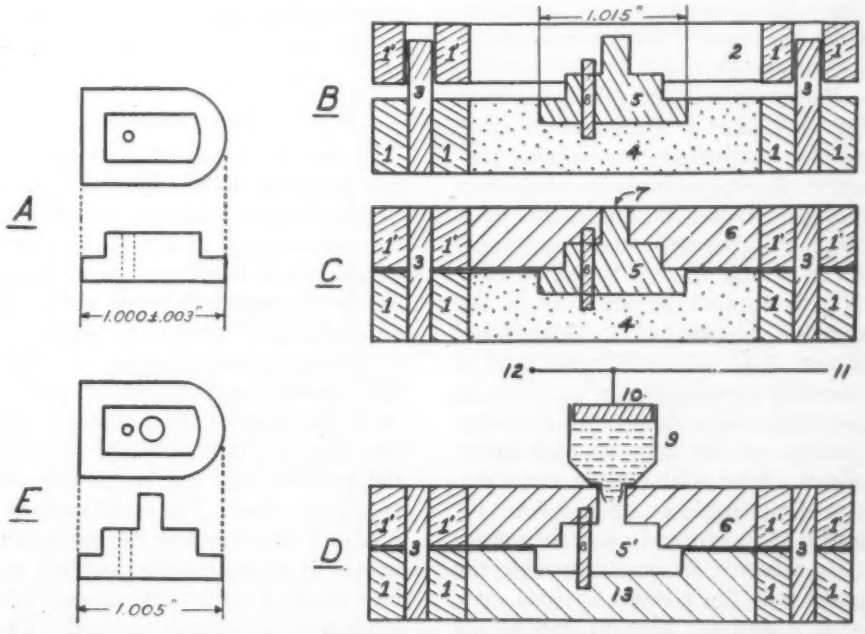


FIG. 8—PRODUCTION OF METAL DIE AND WAX PATTERNS. A—VIEWS OF CASTING ACCORDING TO BLUE PRINT. B AND C—CROSS SECTIONS SHOWING METAL DIE CONSTRUCTION. D—CROSS SECTION SHOWING DIE ASSEMBLED FOR MAKING WAX PATTERN. E—VIEWS OF FINISHED PATTERN. 1 AND 1′—STEEL MATRIX. 2—RECTANGULAR OPENING CUT IN STEEL. 3—HOLDING PINS. 4—PLASTIC CLAY. 5—MASTER PATTERN. 6—FUSIBLE METAL FORMING UPPER MOLD HALF. 7—ENTRANCE SPRUE FOR WAX. 8—PIN SET IN DIE FOR FORMING HOLE IN PATTERN. 9—WAX GUN. 10—WAX GUN PISTON. 11 AND 12—WAX GUN HANDLE. 13—FUSIBLE METAL FORMING LOWER MOLD HALF.

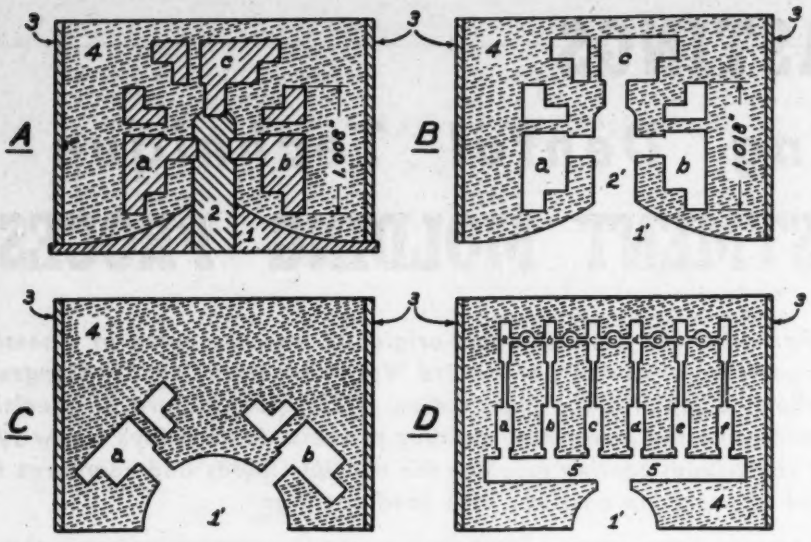


FIG. 9—PATTERN MOUNTING, INVESTING AND DISSIPATING. A AND B—TYPICAL PATTERN ASSEMBLY. A —BEFORE BURN-OUT. B—AFTER BURN-OUT. C—TWO-PATTERN ASSEMBLY. D—TYPE OF PATTERN ASSEMBLY CONFIGURATION ESPECIALLY ADAPTED TO THIN-SECTIONED CASTINGS. 1—CRUCIBLE FORMER. 1'—CRUCIBLE. 2—SPRUE FORMING ROD. 2'—SPRUE. 3—METAL RING FORMING FLASK. 4—INVESTMENT. 5—MAIN GATE. 6—BLIND RISERS. "A-B-C-D-E-F" PATTERN CAVITIES.

This will be one per cent, for example. The finished pattern, as shown at *E* in Fig. 8, will have its critical dimensions one per cent smaller than the die chamber. It is now 1.005 in. long.

Pattern Assembly. Figure 9 *A* shows a typical pattern assembly. The base is a crucible former (1) into which a sprue forming rod (2) is inserted. Patterns *a, b* and *c* are held in recesses in the rod by means of an adhesive, such as hot wax. The metal ring (3) is placed on the crucible former. It forms the flask into which investment is poured to form the mold. The investment is shown as (4).

Pattern Mounting. For example, Fig. 9, *C* and *D* show several other possible methods for assembling patterns. In *C,* two patterns are shown but this could be increased to a larger number dependant upon size. As in *A* and *B,* Fig. 9, the crucible (1') is formed by removal of the crucible former (1). The mold shown at *D* uses a different type of assembly configuration[4]. This is especially desirable for thin-sectioned castings to be cast of high-fusing alloys. Note that molten metal enters the crucible or main sprue (1') and is then spread in a main runner (5), whence it flows through the gates into the pattern cavities *a, b, c, d, e* and *f.* The far end of the castings are connected by small gates to shrink bobs or "blind risers" (6). There are many other possible configurations for mounting patterns. The methods of mounting used are dependant on several factors, among which are the following:

(1) The economy to placing as many patterns as possible in one mold.
(2) The ability of the metal to fill all patterns before solidifying.
(3) The ability of the metal to freeze selectively, first in the pattern and then in the gates or sprues.
(4) Ease with which the patterns may be mounted and with which the gates and risers can be removed from the castings.

INVESTING

Water is measured and poured into a mixer, investment material is weighed and gradually sifted into the water into which it is incorporated by a hand spatula or knife. The components then are mixed in an electrically driven spatulator for a predetermined interval of time. The mixed investment is poured from the mixing bowl directly into the ring or flask, entirely covering the patterns and is leveled with the top of the ring. The mold assembly is placed on a vibrator during investing so as to assure the patterns being covered with investment and entrapped air driven upward. The investment is shown as (4) in Fig. 9, *A, B, C* and *D.* It is mandatory that the patterns be assembled so as to permit air to be displaced upward by the investment and not entrapped in "blind corners." The investment expands 0.3 per cent on setting and the mold cavity is 1.008 in. (Fig. 9 *A*).

MOLD BURNOUT

After the investment has set (about 30 min.), the crucible former (1), Fig. 9 *A,* is removed and the pin (2) is heated with a small torch. This melts the wax on its surface and the pin can be pulled out. The mold is handled sprue hole down to prevent the entrance of dirt and to let the wax run downward as the mold is heated. The molds are placed in gas or electric furnaces and heated slowly to the desired temperature, usually between 1000 and 1300° F. (538 to 705° C.). This temperature is sufficient to volatilize and burn away the wax. Thus the disappearing wax patterns leave mold cavities into which the molten metal can be cast. The molds should be heated from one to 4 hr., as investments are low heat conductors and too rapid heating (or cooling) will cause uneven expansion (or contraction), resulting in cracked molds.

To recover the wax, it is advisable to give the molds a prolonged preheating at a low temperature, 200 to 300° F. (94 to 149° C.). This melts the wax and lets it flow into receptacles where it is collected. The temperature must be kept comparatively low to prevent decomposition of the wax. When the patterns have insufficient bulk to make reclaiming economical, the mold may be placed in the furnace directly and the wax dissipated.

Wax goes through several stages in being dissipated. First it softens and then melts. Some of the molten wax is absorbed by the porous investment. Like most organic materials, it begins to decompose on heating; some volatilizes and the remainder carbonizes. Continued heating burns away the carbon at a rate that increases with temperature and time. The investment used expands 1.0 per cent on heating, producing a mold cavity that measures 1.018 in. (Fig. 9 *B*).

CASTING

(1) Pressure Methods

Dental Type Casting Machine[11]. For the small type of casting made in dentistry, pressure casting is used on an equal footing with centrifugal

casting. A typical casting machine of this type is shown in Fig. 10, *A*. The machine base (1) has a self contained pressure tank (2). Air is compressed therein manually by piston pump (3), or compressed air may be secured from an outside source through valve (4). Pressure is indicated on gage (5). The mold or flask is placed at (6), metal is placed at (7) to be melted by a torch (or molten metal may be poured) directly on the investment. The concave upper surface of the investment acts as a crucible. By pressing down the handle (8) the head (9) is lowered onto the mold, at which time valve mechanism (10) opens and permits compressed air from the base tank to pass through flexible hose (11) and impinges on the molten metal to force same into the pattern chambers. It is to be noted that there are separate sprues to each pattern, and that these sprues are of small cross-section; otherwise, the molten metal might run down the sprue hole prematurely.

Arc Furnace Type (Fig. 10 *B*). An ingenious arc furnace pressure casting machine used for casting supercharger buckets[4, 5, 23] is shown in Fig. 10 *B*. It is a totally enclosed arc furnace (1) with electrodes (2). In practice, the metal (3) is melted, the mold (4) is held securely by a clamp (8) on the furnace. The entire assembly is then inverted about trunnions (5) around the electrodes, the metal runs into the mold cavity (6) aided by air pressure admitted through (7).

Standard practice utilizes pressure from 5 to 25 psi. The permeability of investments is not great enough to permit casting by gravity, but is sufficient to permit casting with comparatively low additional pressure. Thin sections may be cast successfully in heated molds. Higher temperatures are generally more effective than increased pressures. The high pressures used in metal die casting are not necessary since the molds are permeable and low heat conductors, the latter property permitting the metal to remain fluid longer. Standard investments will not withstand too high pressure, as their hot compressive strengths are about 400 psi., and the tensile strength about 100 psi.

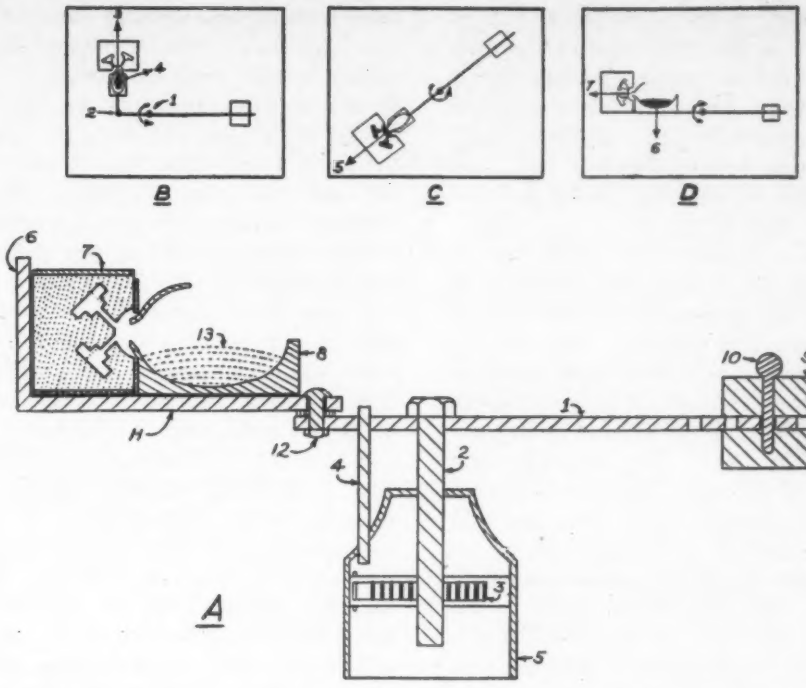


Fig. 11—A—Typical Dental Type Centrifugal Casting Machine. 1—Arm or Beam. 2—Vertical Axis Shaft. 3—Motivating Coiled Spring. 4—Cocking Pin. 5—Base. 6—Backstop. 7—Mold. 8—Crucible or Melting Furnace. 9—Counterbalance. 10—Counterbalance Pin. 11—Arm Section. 12—Pivot. B and C—Drawings Illustrating Forces Acting on Molten Metal in Pivoted Type Centrifugal Casting Machine. 1—Vertical Axis. 2—Pivot Point. 3—Point of Principal Force of Inertia on Metal at Instant of Release. 4—Added Force of Inertia After Arm Has Pivoted About (2). 5—Direction of Centrifugal Force After Mold Assembly Has Made a Portion of Turn. D—Solid-Arm Type Centrifugal Casting Machine Spinning in Vertical Plane About Horizontal Axis. 6—Direction of Inertia Force. 7—Direction of Centrifugal Force.

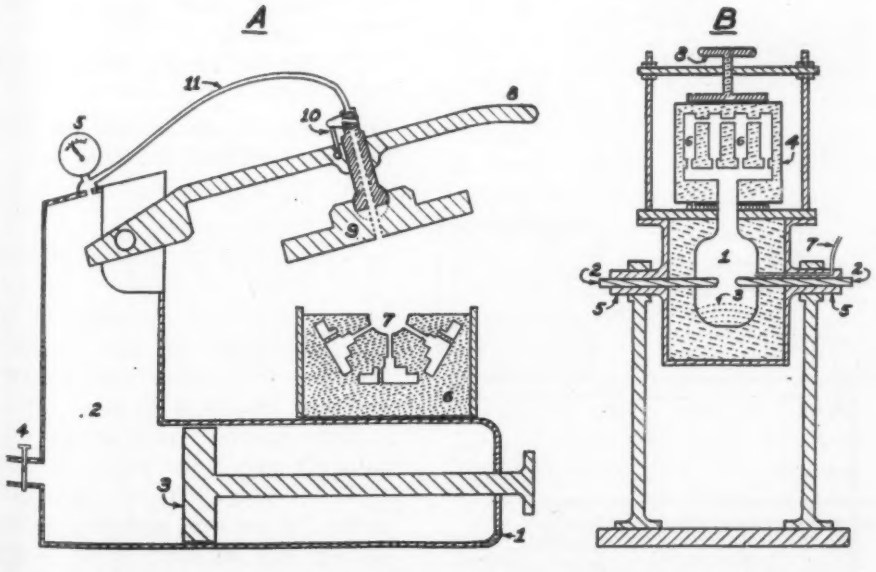


Fig. 10—A—Line Sketch of Pressure Type Casting Machine. 1—Machine Base. 2—Air Pressure Tank. 3—Piston Pump. 4—Compressed Air Valve. 5—Pressure Gage. 6—Mold. 7—Crucible. 8—Handle. 9—Head. 10—Air Valve Mechanism. 11—Air Hose. B—Arc Furnace Pressure Casting Machine. 1—Enclosed Arc Furnace. 2—Electrodes. 3—Molten Metal. 4—Mold. 5—Trunnions for Inverting Assembly. 6—Mold Cavity. 7—Air Pressure Line. 8—Mold Clamp.

(2) Centrifugal

Dental Type Machine. In Fig. 11, *A* is an illustration of a typical dental type centrifugal casting machine. In this type, the mold spins about an axis exterior to the mold.

This machine consists of an arm bar or beam (1) pivoted on a vertical axis shaft (2). It is motivated by a coiled spring (3) being held in a cocked position by a pin (4). This mechanism is contained in a base (5) secured to a table. At one end of the arm bar is a backstop (6) against which the mold (7) rests. A crucible or a melting furnace is placed at (8). To give a smooth

rotation, a counterbalance (9) is placed at the other end of the arm and held in proper position by a pin (10). The usual dental type has a straight arm bar. Another type[22] has a section of the arm bar (11) capable of rotating about a pivot (12), Fig. 11 *A*.

In operation, the arm bar is turned in a clockwise direction to wind the spring (3) to the required tension (2 to 6 turns). The pin (4) is raised to hold the bar in a cocked position. The metal (13) is molten, or molten metal is poured into the crucible (8). The counterweight (9) at the end of the bar is given a slight forward pull, the pin (4) drops and the entire assembly begins to spin about the central axis shaft (2). The centrifugal force generated caused the molten metal to run into the mold cavities, and the continuous spinning maintains this force until the effect of the spring is spent. Figure 11 *B* and *C* illustrate the forces on the molten metal in the centrifugal casting machine of the pivoted or "broken" arm type. The entire assembly spins in the horizontal plane about the vertical axis (1). The left end of the bar is "broken" and pivots about (2). At the instant of release, the principal force of inertia on the metal is shown as (3). The mold actually starts forward and then the "broken" arm is thrown to the left about (2), adding to the force of inertia (4). In the straight-arm type, the force should be almost entirely (4) and the metal tends to be thrown out of the side of the crucible. The "broken" arm tends to give a greater starting force parallel to the direction of the mold.

Figure 11 *C* shows the assembly after a portion of a turn, and the force is now centrifugal in the direction (5) and the metal is in the mold and held until it solidifies.

Figure 11 *D* illustrates a solid-arm centrifugal casting machine spinning in the vertical plane about a horizontal axis. The central arrow shows the direction of rotation. In this case, inertia tends to force the metal against the bottom of the crucible, as at (6), until rotation has built up centrifugal force (7) to force the molten metal into the mold.

New Type of Centrifugal Casting Machine for Multiple Molds. The dental type of centrifugal casting machine is excellent for a number of castings, but it permits the use of but one mold at a time. This can be overcome by using a battery of casting machines, or by a new type of design[4] that is being used in many variations. Figure 12 shows a machine of this general type. In it, the molds may be placed at both ends of the arm, or a number of molds may be placed around the circumference, each being fed from the center by gates, resembling the spokes of a wheel. For example, (1) is a base rotating about central shaft (2). It is motor driven with adequate speed control. Metal is poured from a ladle, or directly from a furnace (3) into a central pouring pit (4). The mold is rotating and the metal is forced into molds (6) and (7) through side gates or runners (5).

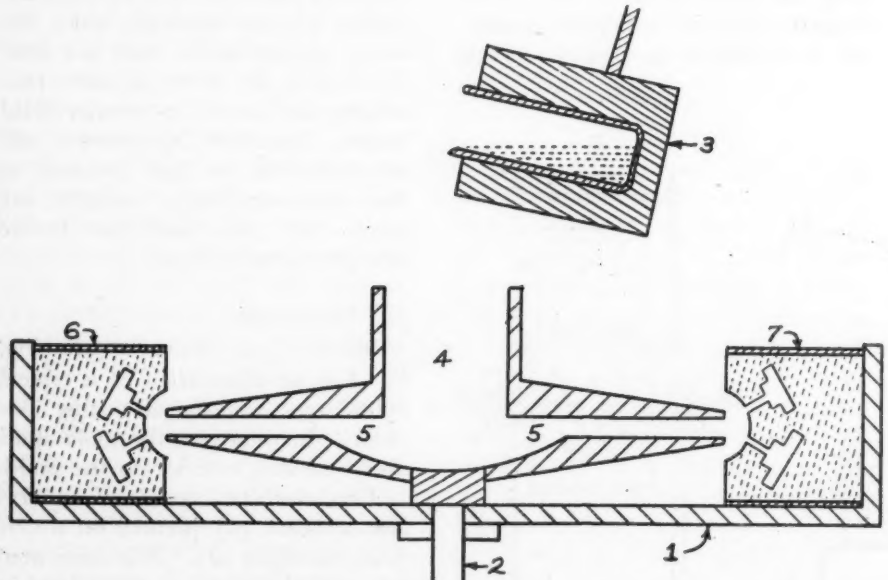


FIG. 12—MULTIPLE-MOLD CENTRIFUGAL CASTING MACHINE. 1—BASE. 2—CENTRAL SHAFT. 3—LADLE OR FURNACE. 4—CENTRAL POURING PIT. 5—SIDE GATES OR RUNNERS. 6 AND 7—MOLDS.

Factors Affecting Casting Time. An interesting study of centrifugal casting has been made by Myers[19] who shows the following: a dental casting using an 11-gauge sprue and five winds of the casting machine is made in 0.38 sec., at which time the machine has attained a speed of 528 rpm.

The formula for centrifugal force is

$$\left(F = \frac{4\pi^2 mn^2 r}{g}, \right)$$

where $\pi = 3.1416$
m = mass of the metal in lb.
r = radius of circular path in ft.
g = gravity constant (32.2).
n = number of revolutions per sec.

Thus the force is increased:

(1) Directly as the mass of metal *(m)*.
(2) Directly as the distance of metal from axis of rotation *(r)*.
(3) By the square of the speed *(n^2)*.

Additional factors to decrease time required for filling the mold are:

(1) Increased sprue size (cross section area).
(2) Tapered crucible to increase "head" of metal.

Many castings are completed in the first revolution of the machine. Pressures used (centrifugal or pressure) are from 5 to 25 psi.

After casting (pressure or centrifugal) into a hot mold cavity of 1.018 in. (Fig. 9 *B*), the metal will shrink 1.8 per cent and the resulting casting will measure 1.000 in. per original specification (Fig. 8 *A*).

After the metal is cast, the mold is permitted to cool at such a rate as will give the best physical prop-

erties to the alloy. A dentist quenches his mold from a red heat directly in water so as to maintain the gold in an annealed condition. Brasses usually need slower cooling and sometimes are permitted to cool down completely in the mold.

The investment is then "dug" away and the remainder brushed off with a stiff brush under running water. The next step is cutting off the sprues. This usually is done on an abrasive cut-off wheel or on a metal band saw. The remainder of the projecting sprue often can be removed on a disc sander.

Any final close tolerance machining now is done. This includes reaming, turning, tapping, and sometimes buffing.

Completed castings are inspected by standard machine shop practice; gages are used, including snap and thread gages, micrometers, dial gages, etc.

Casting Precision

Figure 13 illustrates the precision possible in investment casting. The data were secured by measuring 100 patterns and castings at random from the production line. The average size of patterns and castings is used as the origin, plus or minus 0.000. Measurements were taken by means of a micrometer at 0.0005-in. intervals on patterns and 0.001-in. on castings, and the frequency or percentage which occurred at, above and below the average measurements were plotted as shown by circled points. The points were connected to give a frequency - tolerance curve. Broken lines indicate the tolerances for patterns and solid lines those for castings.

It is to be noted that 58 per cent of the patterns occurred at the average dimension and another 37 per cent (30 plus 7) were plus or minus 0.0005 in., or a total of 95 per cent were within a tolerance of plus or minus 0.0005 in., and 100 per cent were within plus or minus 0.001 in.

The curve of castings is of a similar shape, but covers a wider range of tolerance, as would be expected. Eighty-nine (89) per cent were plus or minus 0.0005 in. Another 9 per cent were plus or minus 0.0015 in., and the remaining 2 per cent were minus 0.0025 in.

The percentage of useful castings depends upon the tolerance permissible in the specifications. Obviously, those above size may be brought down to size, but undersize castings must be remelted and cast again. Where extreme accuracy is desirable, such as plus or minus 0.0005 in., it is possible to use 89 per cent of the castings. For this extreme precision, 89 per cent efficiency (11 per cent loss) is quite economical. This 11 per cent is not a total loss, as the metal can be remelted and cast again.

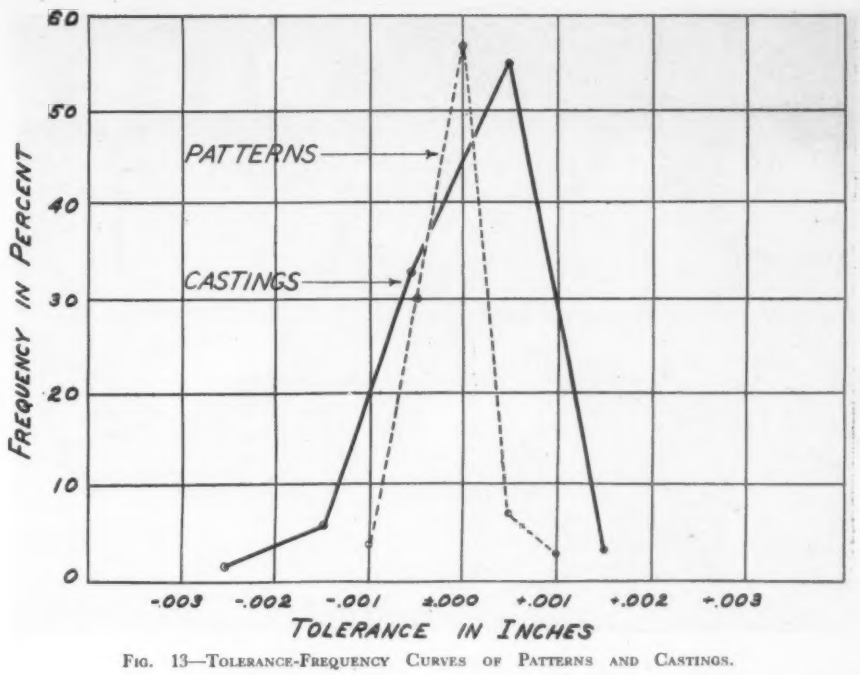


Fig. 13—Tolerance-Frequency Curves of Patterns and Castings.

The foregoing figures were secured under carefully controlled conditions by the use of the latest developments in patternmaking and casting, and may be taken as the precision possible in in. per in. of length. These figures cover precision and are a scientific measure of the precision casting process. This shows the variation of one pattern or casting from another or from the average dimension.

The practical measure is known as accuracy and involves the measure of tolerance from the specified dimensions. For example, the casting used as an illustration herein had a specified dimension of 1.000 in., plus or minus 0.003 in. If the average dimension of our casting is 1.000 in., then all would pass the requirements and the accuracy would be met 100 per cent. If the average casting dimension is 1.004 in., then most of the castings would be rejected and the accuracy would be low even though the precision is high.

High precision shows that the material and process is working very uniformly. Low accuracy may be due to the use of incorrect values in the compensation calculations. The use of 2.4 per cent instead of 2.0 per cent for the shrinkage of brass will cause the casting to be 0.004 in. too large. If the die was to be 1.015 in. but was made 1.019 in., the same large casting would result. Considering the possible combined errors in our available figures for the shrinkage of wax patterns, the setting and thermal expansion of investment and the casting shrinkage of the alloy, it is advisable to double the above illustrated precision tolerance to secure a commercially feasible accuracy tolerance.

A wide variation in precision is difficult to correct, but errors in accuracy can be more easily eliminated. For example, if the castings are uniformly 0.004 in. oversize, it is only necessary to make the die 0.004 in. smaller. The possibility of making dies quickly and cheaply is a great aid in making precision castings accurate. Once the die is made to the correct determined size, the accuracy of the casting can be made nearly the same as the precision.

Conclusions

Having reviewed the theory and practice of precision casting, it is now in place to compare its applications with those of other methods.

(1) Fields of Application of Precision Casting

The fields of application for the

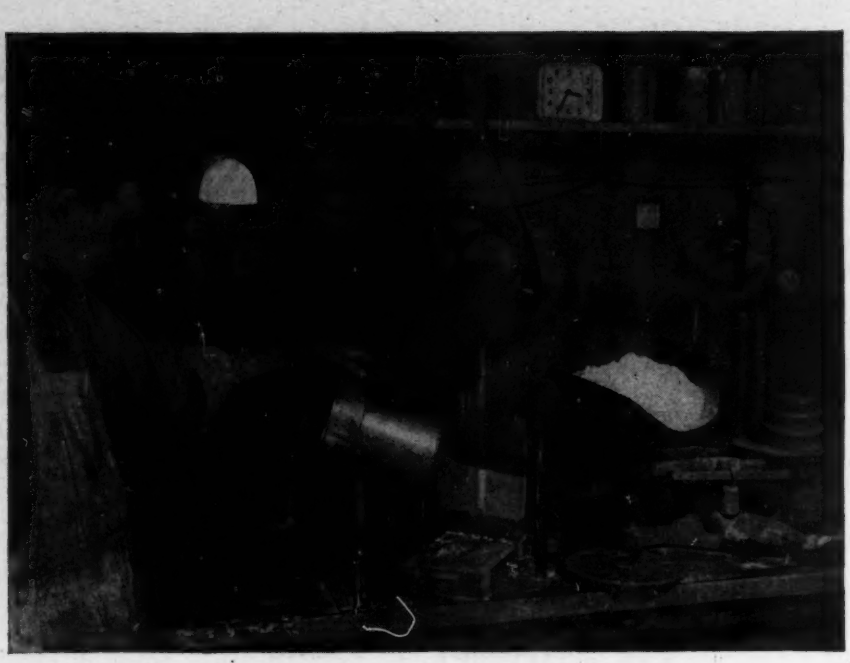


FIG. 14—MIXING INVESTMENT AND INVESTING MOLD.

precision casting method may be summarized as follows:

(a) The principal indicated field of precision cast parts is to displace those requiring many machining operations or hand fabrication.

(b) Where alloys are unusually difficult to machine.

(c) Many parts have specifications calling for tolerances of plus or minus 0.005 in. (decimal dimensions) and 1/64 in. on fractional dimensions, with one or several dimensions held to very close limits, such as plus 0.0007, minus 0.0003. Here a part can be precision cast to all but the latter extreme tolerance, and this would be so nearly to size as to require only a finishing cut in machining.

(d) Where a smooth, clean surface adds utility and beauty.

(e) For small runs where other pattern or die costs are too expensive or time consuming to produce.

(f) Where special metallurgical and metallographic conditions are required.

(g) To produce sizes and shapes wherein suitable bar stock, tubing or forgings are not available.

(h) As a starting point for machining wherein a sand casting is too rough or inaccurate to permit proper chucking. Here the investment process can be used and economies secured by easing up on tolerance requirements.

(i) To provide special markings, numbers, graduations, blind holes, etc.

(j) Where the presence of a parting line is unsightly or too inaccurate, and where appreciable draft is undesirable.

(2) Cost of Precision Casting

In this most important factor, it must be stated that a precision casting is more costly to produce than a sand casting. However, in all fairness the cost of a precision casting must be compared with a sand casting on which there has been carried out those machining operations necessary to meet specifications. Likewise, when a precision casting requires some critical machining, this cost must be added before a fair comparison can be made with a totally machined part. In comparing costs with die casting, it is necessary to take into account original die cost and the life span of the die.

Whereas sand castings usually are sold on a per lb. basis, precision castings usually are sold as finished pieces. It is comparable to a machined part where finishing cost usually far exceeds the cost of the metal, and a small part may be much more costly than a less intricate large part.

With more experience in the comparatively new precision casting field and with utilization of mechanized mass production methods, costs will be lowered and more precise figures will become available for direct comparison with those by other methods. At present, each job involves something new, and costs are merely estimates.

(2) Future Work

Some of the paramount desires of the precision caster, and ones on which the various research departments are working, are:

(a) Materials

(1) Harder low-fusing die metals.

(2) Waxes with less shrinkage.

(3) More refractory and less costly investments.

(b) Equipment

(1) Automatic patternmaking machines.

(2) Larger casting equipment.

As improvements in materials and enlargement of equipment are made, it will be possible for investment to replace permanent molds, sand and sand cores in more and more types of casting work.

Precision casting is not a process that just any foundry can adopt at present. It requires equipment, apparatus and materials that present users have developed and built for their own use, and materials especially formulated for their process. It is believed that, as these means are perfected to a point where consistent results will be possible without constant scientific supervision, the process can be made more generally available. Just as Dr. Taggart[2] developed dental casting and then made his materials and apparatus available to others, so precision casters will do likewise. At present, no two investments or casting machines are alike; once the merits of each are more widely known and generally available, one may look to rapid improvement and growth of precision casting practice.

INDUSTRIAL PRACTICE

Figures 14 to 20 illustrate operations in a precision casting foundry.

Figure 14 shows a mold being invested. Note the graduate for measuring water, scale for weighing investment to ¼ oz. accuracy, and clock for accurate timing of the mixing operation. The mold is vibrated electrically to permit the investment to level itself quickly. Investment is spatulated by the electrically-driven blade mixer.

Figure 15 shows a battery of 24 electric furnaces for dissipating or burning out the patterns. They are provided with individual and averaging thermocouples for temperature measurements and automatic and electronic controls for regulating temperature, heating rate, cut-off time and air flow to sweep out vapors and combustion products.

Figure 16 shows a high-frequency induction furnace for melting metal and a large casting machine based on the principles of the dental pressure casting machine of Fig. 10. Note the thermocouple and pyrometer for accurate metal temperature measurement, time clock and gages for accurate controls.

Figure 17 shows a group of dental type centrifugal machines adapted to take large molds and special crucibles. A helper loads and unloads the molds and the melter follows in succession from one machine to another. Note the control dials for the burn-out furnaces (to the right of the melter).

Figure 18 shows the molds being broken up and the castings being "dug out." Note the castings in the front and rear and some still under water.

Figure 19 shows a band saw for cutting the castings away from the sprue and a sander for removing the sprue stumps from the casting to give a surface flush with the casting.

Figure 20 shows the gaging of castings for dimension as well as the inspection of patterns and castings for imperfections.

Laboratory Control

The section dealing with the principles of precision casting has illustrated the interdependence of the physical units of length, mass, temperature and time. The successful production of precision castings depends upon proper control of these factors.

(1) Precision entails — means for assuring reproduction of contions (mass, temperature and time).

Fig. 16—High-Frequency Induction Furnace for Melting Metal and Large Dental-Type Pressure Casting Machine.

Fig. 17—Group of Dental Type Centrifugal Casting Machines.

Fig. 15 — Battery of Electric Burn-Out Furnaces.

(2) Accuracy entails—knowledge of dimensional (length) changes of all materials used.

The illustrations (Figs. 14 to 20) show the ever presence of instruments and apparatus to measure and automatically control the conditions necessary for precision.

The maintenance of accuracy has its foundation in the research and control laboratory, where the physical properties of all materials are determined and standards maintained. The most important properties include setting and thermal expansion measurements (dilatation).

Figure 21 shows a precision micrometer comparator. In the illustration, a V-shaped trough is filled with a mixture of investment in the plastic state and metal markers are set therein about 10 in. apart. The micrometer microscopes are focused thereon, and the expansion on setting is followed and measured in units of 0.000005 in. per in. of specimen length.

This comparator also is used to measure expansions near room temperature of materials, such as waxes. A controlled constant temperature water bath is used instead of the trough. The curves in Figs. 2 and 3 were determined on this instrument.

Figure 22 shows Bureau of Standards type dilatometers for measuring thermal expansion by the fused quartz method. At the left is a dilatometer with fused quartz tube assembly. The expansion (and contraction) of the specimen during heating is indicated on the dial gage in terms of 0.00001 in. per in. of specimen length. In the center of the illustration is a potentiometer pyrometer for measuring temperature by means of thermocouple wires

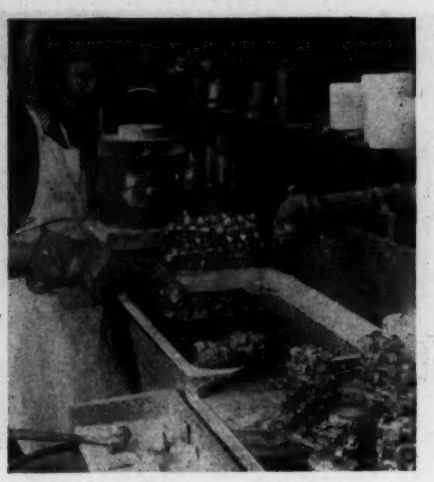


FIG. 18—BREAKING INVESTMENT MOLDS AND "DIGGING OUT" CASTINGS.

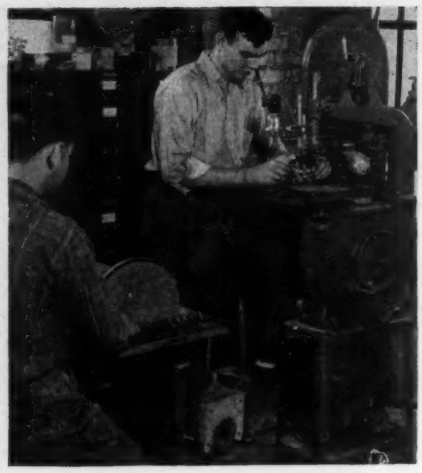


FIG. 19—BAND SAW FOR SPRUE CUT-OFF AND SANDER FOR REMOVING SPRUE STUMP.

FIG. 20—GAGING AND INSPECTION OF PATTERNS AND CASTINGS.

Appendix I

PATTERN WAX FORMULAE

No. 1	*Per Cent*	No. 2	*Per Cent*
Paraffin (55° C.)	60.0	Paraffin	4.0
Carnauba	25.0	Stearic Acid	43.0
Ceresin	10.0	Damar	43.0
Beeswax	5.0	Beeswax	6.0
		Tamarack	4.0
No. 3		No. 4	
Paraffin (120° F.)	30.0	Paraffin (70° C.)	35.0
Carnauba	30.0	Carnauba	10.0
Ceresin	20.0	Beeswax	55.0
Beeswax	10.0		
Damar	10.0		
No. 5		No. 6	
Diglycol Stearate "S"	16.5	Paraffin	10.0
Acrawax "B"	19.5	Carnauba	40.0
Beeswax	22.0	Beeswax	10.0
Ceresin	42.0	Rosin	40.0
No. 7		No. 8	
Ozokerite	61.0	Ceresin	70.0
Paraffin	29.0	Beeswax	30.0
Rosin	10.0		
No. 9		No. 10	
Beeswax	67.0	Beeswax	1 lb.
Rosin	33.0	Venice turpentine	1 oz.
Venice turpentine (small amt.)		Glycerine (few drops)	

NOTES: The above formulae were found in references[8] and[20], also in catalogs and from private sources.
Formulae 1 to 4 are recommended for dentists[8].
Formulae 5 to 10 are recommended for jewelers and precision casters.

attached to the center of the specimen. At the right is another dilatometer, also an exact replica of that used at the Bureau of Standards. The data for Figs. 3 to 7 were determined on these dilatometers.

ACKNOWLEDGMENT

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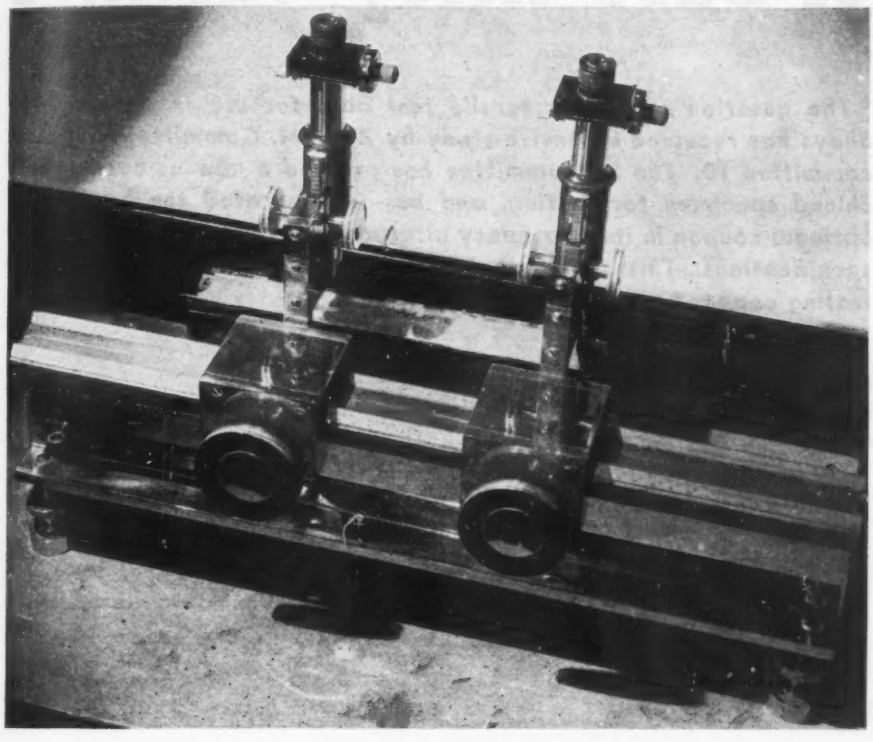


FIG. 21—PRECISION MICROMETER COMPARATOR. THE "V" TROUGH IS FILLED WITH PLASTIC INVESTMENT MIXTURES.

FIG. 22—DILATOMETERS (BUREAU OF STANDARDS TYPE) FOR MEASURING THERMAL EXPANSION BY FUSED QUARTZ METHOD. LEFT—DILATOMETER WITH FUSED QUARTZ TUBE ASSEMBLY. CENTER —POTENTIOMETER PYROMETER FOR TEMPERATURE MEASUREMENT. THERMOCUPLE WIRES ARE ATTACHED TO CENTER OF SPECIMEN.

Appendix II

INVESTMENT FORMULAE

No. 1[8]	*Per Cent*
Plaster of Paris	30.0
Silex (powdered)	70.0
No. 3[8]	
Plaster of Paris	50.0
Powdered mica	25.0
Marble dust	25.0
No. 5[10]	
Plaster of Paris	30.0
Cristobalite	50.0
Tridymite (and silica)	20.0
No. 7[12]	
Calcined gypsum	80.0
Asbestos fiber	20.0
No. 9[16]	
Silica	67.0
Liquid—tetraethyl silicate 8 vol., water 1 vol., alcohol 1-2 vol., hydrochloric acid (few drops)	33.0

No. 2[8]	*Per Cent*
Plaster of Paris	52.0
Marble dust	16.0
Graphite	16.0
Soapstone (powdered)	16.0
No. 4[9]	
Alpha gypsum (21)	30.0
Silica (200-400 mesh)	62.0
Andalusite (fine)	5.0
Alundum (fine)	1.0
Boric acid	2.0
No. 6[11]	
Calcined gypsum	30.0
Silica	69.0
Strontium chloride	1.0
No. 8[14]	
Plaster of Paris	60.0
Silica	25.0
Talc	15.0
No. 10[17]	
Silica	90.0
Magnesia	6.0
Monobasic ammonium phosphate	3.0
Monobasic sodium phosphate	1.0
Liquid—water or 10 per cent hydrochloric or nitric acid	

NOTES: Numbers of above formulae refer to type.

Formulae 1 to 3 are old types of dental investments of low expansion. Formulae 4 to 6 are new types dental investment of high expansion. Formulae 7 and 8 are mixtures for plaster casting. Formulae 9 and 10 are investments for stainless high fusing alloys.

Simpson Fellowship At Northwestern U.

BRUCE L. SIMPSON, president, National Engineering Co., Chicago, has advised the National Office that his company has established the Peter L. Simpson Memorial Fellowship at Northwestern Universty Institute of Technology, Evanston, Ill. The fellowship is in the Mechanical Engineering Dept., and will be used by gradute students for research on the use of foundry sand control.

Subjects studied will be of a pure research nature. Results of research through the above-mentioned fellowship will be presented to the American Foundrymen's Association at its annual meetings, if and when information is available.

A.F.A. will cooperate closely with Northwestern University Institute of Technology, Mechanical Engineering Dept., in an advisory capacity, in connection with the work of the Peter L. Simpson Research Fellow.

The fellowship has been named for Peter L. Simpson, founder of the National Engineering Co., who was the father of Herbert S. Simpson, now chairman of the board of the company, and who has served as president of your organization, a member of the Board of Directors, a past chairman and member of the Board of Awards, and a member of the Advisory Board. He was likewise grandfather of the current president of the National Engineering Co., B. L. Simpson.

AS-CAST TEST BAR

Provided Through Investigation by A.S.T.M.

For Copper-Base Alloy Castings

The question of proper tensile test bars for use in copper-base alloys has received extensive study by A.S.T.M. Committee B-5, Subcommittee 10. The Subcommittee has evolved a new as-cast, unmachined specimen for testing, and has incorporated the bar as an optional coupon in its emergency alternate provisions to a number of specifications. This article deals with the various test bars used for testing copper-base alloys.

BECAUSE of the great variation in standard specifications for tension test specimens and because evidence indicated that none of the specified bars approached the ideal test bar, Subcommittee 10, A.S.T.M. Committee B-5, on Copper-Base Alloys for Sand Castings, undertook an investigation to determine what type test specimen coupon would produce the most nearly ideal tensile test specimen for copper-base alloy castings.

As a result of this investigation, a report entitled "Studies of Machined versus As-Cast Test Specimens for Copper-Base Alloy Sand Castings" was presented to Subcommittee 10. This report was prepared and submitted by the following members of A.S.T.M. Committee B-5, whose companies or agencies conducted research work on the test bar problem:

J. J. Curran, Chief Metallurgist, Walworth Co., Inc., Greensburg, Pa.

J. W. Bolton, Director of Metallurgical Research and Testing, The Lunkenheimer Co., Cincinnati, Ohio.

F. L. Wolf, Chief, Graphite Allocation and Conservation, Materials Division, Branch K, War Production Board, Washington, D. C.

W. E. Martin, Materials Laboratory, Sperry Gyroscope Co., Brooklyn, N. Y.

The report described the advantages and disadvantages of various types of test specimen coupons and made recommendations which resulted in the A.S.T.M. revising the description of test specimens in the Emergency Provisions for several copper-base alloy castings specifications.

The recommendations of Subcommittee 10 and the resultant changes in the Emergency Provisions of the copper-base alloy castings specifications are described in the following paragraphs.

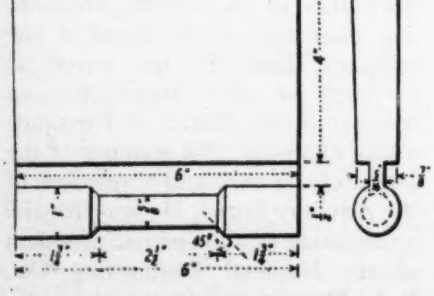


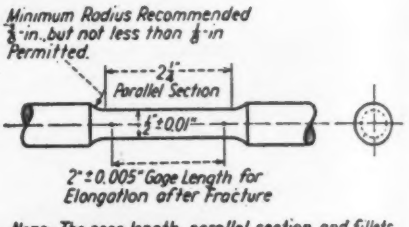
Fig. 1—Tension Test Specimen Coupon.

Purpose of Test Bars

Test bars are poured with castings for the purpose of indicating the condition of the metal at the time of pouring. To do this, a test coupon casting must be as nearly a perfect casting as is possible to produce. All factors which may affect test results, other than metal quality, should be eliminated from the production and testing of specimens. This means that a test coupon must be properly gated and fed to eliminate the molding factor.

J. W. Bolton* says "The test bar should be a measure of the potential soundness of the metal as it goes to the molds." The test bar should show the properties of the metal at its very best. This does not mean, however, that poor melting practice may be disguised by means of accelerated cooling of the casting. On the contrary, test bars *should* indicate poor melting practice if the melting practice was not the best.

Not only is there considerable variation in test bar specifications for different types of alloys, but test bar specifications promulgated by different organizations, or buyers, for any single alloy vary widely. Most specifications for non-ferrous alloys specify not only the dimensions for finish-machined test bars, but also how the test coupons shall be cast. Despite such detailed specifications, evidence has shown that the test bars thus specified are far removed from ideal castings.



Note—The gage length, parallel section, and fillets shall be as shown, but the ends may be of any shape to fit the holders of the testing machine in such a way that the load shall be axial.

Fig. 2—Standard 2-in. Gage Length Machined Tension Test Specimen.

Specification for Test Specimen Coupons

In the past the A.S.T.M. has specified that the test specimens accompanying brass and bronze castings be machined to size from a cast-to-shape coupon attached by a web, running the entire length of the bar, to a wedge-shaped feeder head. This test specimen is known as the Webbert test bar.

Navy and Federal specifications not only require the same Webbert test specimens, but also specify how the coupon shall be gated. Navy and Federal specifications permit the use of the Crown coupon as an optional coupon. The Crown coupon is practically the same as the Webbert cou-

* Director of Metallurgical Research and Testing, The Lunkenheimer Co., Cincinnati, Ohio.

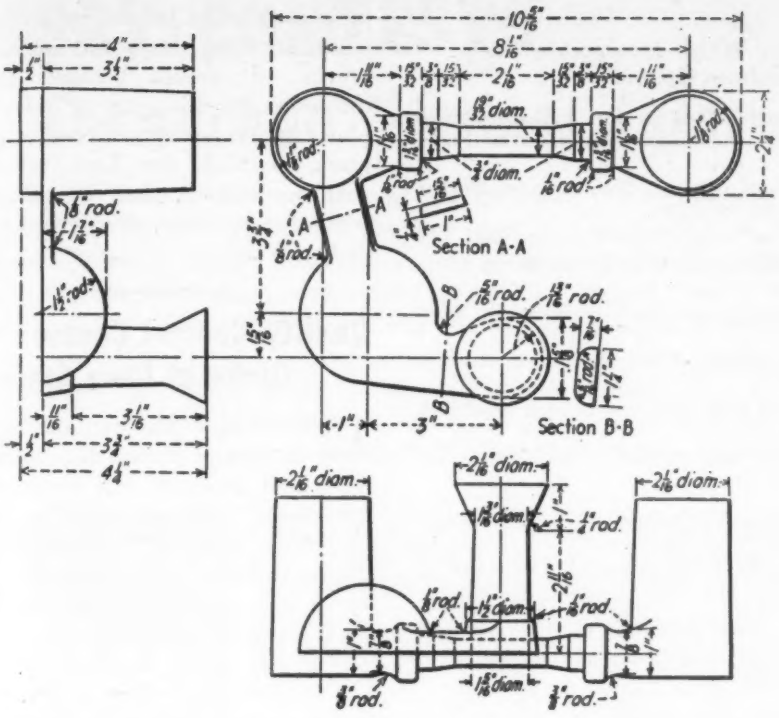


Fig. 3—Optional Coupon for As-Cast Tension Test Specimen, Button Head.

pon except that the web which attaches the test bar to the feeder head runs only the length of the grip sections.

The Webbert test coupon, which has been specified by the A.S.T.M., is shown in Fig. 1.

That the Webbert and Crown coupons do not exemplify the ideal casting has been clearly demonstrated by foundries which pour their coupons with the feeder head in a horizontal position in order to take advantage of greater molding simplicity. In spite of the fact that the feeder is unable to function as such in a horizontal position, horizontally-cast test bars frequently give higher test results than vertically-cast bars. Use of the feeder head appears justifiable only for high-shrinkage alloys such as manganese bronze or nickel alloys.

Both Webbert and Crown bars exhibit a weakness in the fillet section, which is not influenced by the pouring position of the coupon.

Tests performed by W. E. Martin† on machined and unmachined Crown test bars indicated that unmachined test bars had slightly higher properties than machined test bars. Therefore, a great deal of machining time can be saved by using an unmachined test bar.

Optional Test Specimen Coupon

In an effort to eliminate fillet-section weakness and costly machining time and to provide a sounder test bar, The Lunkenheimer Co. developed the test specimen coupon shown in Fig. 3. This coupon, which makes use of a ball gate and adequate risers, can be simply molded. The test bars may be tested in either the unmachined or machined condition. The short grip sections were used because they gave better specimen alignment in the testing machine.

A. S. T. M. Emergency Alternate Provisions Provide for Optional Coupon

Because tests have proved that the new type of test coupon is superior for many copper-base alloys, the A.S.T.M. has issued Emergency Alternate Provisions for eight A.S.T.M. specifications, changing the section which describes the test specimens to read as follows:

"(a) The manufacturer shall have the option of casting test coupons according to Fig. 1, 3, or 4. Because of the web between riser and casting, it is necessary that the gage length of the test specimen prepared from Fig. 1 be machined to the size shown in Fig. 2 before testing.

"(b) In the case of test specimens prepared from the coupons shown in Fig. 3 or 4, the manufacturer shall have the option of testing the specimen without machining the gage length, or the coupons may be machined to the dimensions shown in Fig. 2. Thus the coupons shown in Fig. 3 or 4 shall be mandatory when the test specimens are tested without machining the gage length.

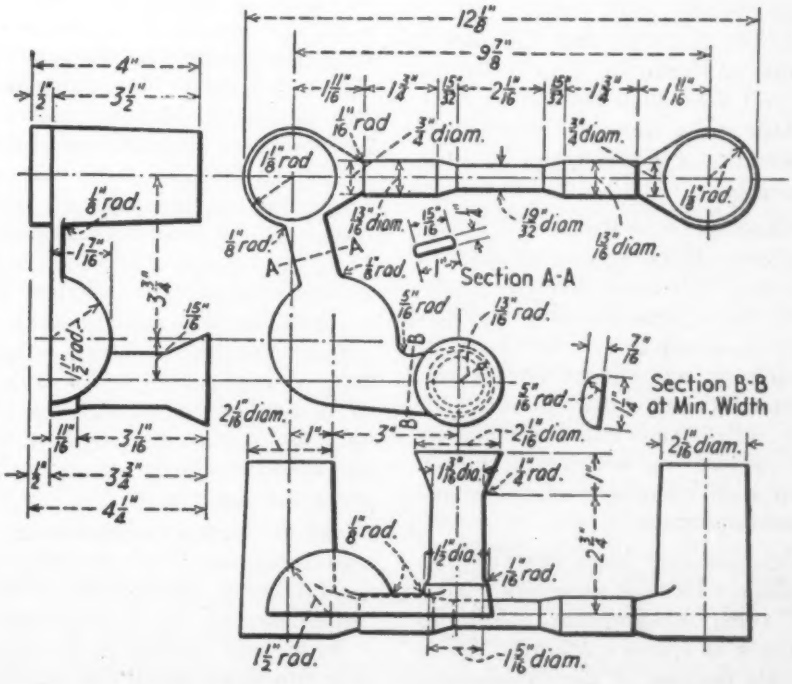


Fig. 4—Optional Coupon for As-Cast Tension Test Specimen, Friction Grips.

† Materials Laboratory, Sperry Gyroscope Co., Brooklyn, N. Y.

TABLE I

A.S.T.M. Emergency Alternate Provisions Which Incorporate the Optional Cast-to-Size Test Specimen Coupon.

EA-B 22a	Tentative Specifications for Bronze Castings for Turntables and Movable Bridges and for Bearing and Expansion Plates of Fixed Bridges (B22-42T)
EA-B 60a	Standard Specifications for Castings of the Alloy: Copper 88 per cent, Tin 8 per cent, Zinc 4 per cent (B60-41)
EA-B 61	Standard Specifications for Steam or Valve Bronze Castings (B61-42)
EA-B 62a	Standard Specifications for Composition Brass or Ounce Metal Castings (B62-41)
EA-B 143a	Tentative Specifications for Tin-Bronze and Leaded Tin-Bronze Sand Castings (B143-42T)
EA-B 144a	Tentative Specifications for High-Leaded Tin-Bronze Sand Castings (B144-42T)
EA-B 145a	Tentative Specifications for Leaded Red Brass and Leaded Semi Red Brass Sand Castings (B145-42T)
EA-B 146a	Tentative Specifications for Leaded Yellow Brass Sand Castings for General Purposes (B146-42T)

Machined to size test specimens may be prepared to the dimensions of Fig. 2 from the coupons shown in Fig. 1, 3, or 4."

Table 1 lists the A.S.T.M. Emergency Alternate Provisions which now incorporate the use of the optional test specimen coupon.

APPRENTICESHIP FOR VETERANS

Through Training-on-the-Job Program

BULLETIN No. 27 of the Industrial Commission of Wisconsin, Apprenticeship Division, Madison, indicates that considerable thought and effort are being expended for the training and education of World War II veterans.

The bulletin contains items relating to handicapped veterans, Public 16; items relation to all other veterans, Public 346 ("G.I. Bill"); Text of Training and Education Section of Public 16; Text of Training and Education Section of Public 346; and a copy of Veterans Administration On-the-Job-Training Agreement.

Paragraph 4 of Part VIII, Public Law 346, 78th Congress, provides in part that "wherever there are established State apprenticeship agencies expressly charged by State Laws to administer apprentice training, whenever possible, the Administrator shall utilize such existing facilities and service in training-on-the-job when such training is of one year's duration or more."

Veterans may enter into apprenticeships under the same wage bases and other employment conditions applying to young civilians. This is possible because of the "subsistence allowance" provided in Public Law 346. It should be understood, however, that the veteran actually must participate in a training program; mere employment in a job is not sufficient to qualify for the subsistence allowance.

Employer Safeguard

Paragraphs 5 and 6 of the "Agreement to Train-On-the-Job Disabled Veterans of World War II" is of particular interest to employers: "It is further agreed that the veteran in the establishment for training under this agreement will be under the control of the establishment and will be subject to such of the rules governing the conduct and work of employees as the establishment may see fit to apply, and that the Veterans Administration will remove from training in the establishment any veteran whose personal conduct, lack of application to his training, or unsatisfactory quality of work is such as to jeopardize the best interests of the establishment or the Veterans Administration.

"It is further agreed that this agreement may be terminated by the establishment or by the Veterans Administration on 15 days' notice."

From the foregoing, it appears that foundries which can qualify as suitable for an apprentice training program should be able to develop workmen from this source of manpower. It would behoove those interested in this class of labor to plan now for an apprenticeship program, because the Law provides that no training shall be afforded beyond seven years after termination of the War.

Quality Control Course Given at Iowa State U.

USE of statistical methods in the control of the quality of manufactured products has resulted in substantial savings in labor and material in many establishments. To make these methods more readily available to industries engaged in the production of goods related to the war effort, the State University of Iowa will offer an intensive 8-day tuition-free course in "Quality Control by Statistical Methods," from October 11 through October 19.

The course is offered in cooperation with the War Production Board and the United States Office of Education under the Engineering, Science and Management War Training Program.

A special one-day session for executives will be held on Wednesday, October 11, for those individuals who are unable to attend the full course. This session will be devoted to an explanation of the aims and the possibilities of a quality-control program and to outline a procedure for the installation of such a program in their plants. It will be largely devoted to illustrations of the ways in which statistical techniques may be applied to quality control rather than to an exposition of the techniques themselves.

The 8-day program will consist of a series of conferences, lectures, and laboratory periods lasting from 8:30 a.m. to 5 p.m. each day except Sunday. General lectures will be given to the entire group. The trainees will be divided into small groups under the direct supervision of an instructor to facilitate the discussion of specific problems and the working of laboratory exercises.

Nominations of individuals to attend the course should be sent to Professor Earle L. Waterman, College of Engineering, State University of Iowa, Iowa City.

ESSAY CONTESTS

Encourage Student Interest

• To instill greater interest among the students taking the foundry courses at Washburne Trade School and Crane Technical High School, Chicago, Bruce Simpson, National Engineering Co., offered prizes for the best essays submitted on "Why I Would Like to Work in a Foundry." Presented here is the winning entry in the Washburne group, submitted by Donald Longanecker, together with pictures of the second and third place winners, Carroll Goress and Donald Swanson. The winning paper from the Crane entries will be presented in a future issue of AMERICAN FOUNDRYMAN.

Carroll Goress

Donald Longanecker

Donald Swanson

MANY students are of the opinion that, since the foundry is one of the oldest branches of industry, the term "foundry" represents hot, dirty, out-moded working conditions. This impression provides little incentive for entering the trade. Frequently students are prone to feel that there is little opportunity for the development of new ideas and new processes in a foundry career. They believe that this industry is one involving simply a question of repetition, which has characterized its past.

Value to Mankind

Let us, therefore, modernize the name of the casting industry from the age-old foundry to its more appropriate title of "Metal Laboratory," as the foundry is in reality a metal laboratory used in the advancement of mankind.

Without this laboratory, it would have been impossible to have conveniences of the home, airplanes, autos, trains, the appliances that cool and heat our schools, shops and factories, and support our increasingly large buildings, plus other things too numerous to mention.

In fact, all changes and articles of our modern life are dependent upon the foundry through the use of castings. The foundryman not only uses the results of research work in many fields but, by constant study of his own technical problems, is adding to knowledge in the service of industry.

Interest

Has anyone a conception of the classification of manufacturing enterprises directly or indirectly embraced by the foundry industry? We can say conservatively that these metal laboratories represent a billion dollar capital investment, a pouring capacity of approximately 30,000,000 tons and 300,000 employees.

Due to the rapid progress of the past few years, the metal laboratories assure a great future to those who have the true perspective, the will to work hard for a few years, the courage to attack a problem without fear or hesitancy, the ambition to find the solution to seemingly insurmountable obstacles and the vision always associated with aggressive youth.

Opportunity

The young foundryman will find an increased opportunity for improving phases of this industry. The developments of new materials that portend a solution of many engineering problems are a great opportunity for youth, providing the youth has the ability and ambition to take hold of this opportunity.

Advancement Possibilities

This extensive metal laboratory holds great opportunities for advancement in all of its branches. It also has many openings for young men with technical training, due to the fact that heretofore young engineers have gone into other industries, leaving the foundry field wide open for the interested youth. Because of this, there is comparatively little competition for executive positions.

Steady Employment

The need for castings to supply the taken-for-granted conveniences of our mode of modern life offers steady employment, now and in the future. This also is backed by the consistently rapid progress being made, creating the use of castings in ever increasing volumes.

Remuneration

Due to the many opportunities and positions at the top, the metal laboratories offer high-paying positions for the young fellow who is a go-getter. This is a factor that is always deserving of serious consideration.

Reason for Choice

These great opportunities, little competition and the chance to develop a better trade are important factors in my reason for selecting this great metal laboratory as a career.

Recommendations Aid in Estimating Casting Costs

RECOGNIZING the importance of accurate data in the compilation of bids for any casting job, a sub-committee of the A.F.A. Foundry Cost Committee, under the chairmanship of C. A. Davis, Caterpiller Tractor Co., Peoria, Ill., has drawn up a set of recommendations to buyers of castings. These recommendations are available at 10 cents per individual copy with special quotations on lots of 50 or more. The booklet is known as publication No. 43-45 of the A.F.A.

NEW ASSOCIATION MEMBERS

(August 16 to September 15, 1944)

• Usually about this time of the year the different membership committees begin planning their campaigns for signing up new members; that is, providing the customary summer lull prevailed. However, there was no sign of that "summer lull" during the period just past, as current listings will indicate, so the 1944-45 season in most cases will simply be a continuance of the untiring work of these committee members. Hats off to these A.F.A. workers, with special praise for the Saginaw Valley Section which has been growing by leaps and bounds.

BIRMINGHAM CHAPTER

Lawrence W. Kendrick, Chief Chemist, LeTourneau Co., of Georgia, Toccoa, Ga.

CENTRAL INDIANA CHAPTER

C. W. Hockman, Factory Administrator, Associated Engineers, Inc., Fort Wayne, Ind.

CENTRAL NEW YORK CHAPTER

W. A. Mader, Chief Metallurgist, Oberdorfer Foundries, Syracuse, N. Y.

CHICAGO CHAPTER

***Bordite Corp., Hammond, Ind. (Frank Myers, Mgr.)**
***The Chicago Faucet Co., Chicago, Ill. (H. E. Younger, Supt.)**
Robert E. Etherton, Chicago District Engineer, Peninsular Grinding Wheel Co., Chicago.
Joe Gibson, Supt., McCarthy Foundry Co., Chicago.
Bert E. Sandell, Chief Metallurgist, Stewart Die Casting Div., Stewart-Warner Corp., Chicago.

CINCINNATI DISTRICT CHAPTER

John W. Boers, Foreman, The Cincinnati Milling Machine Co., Cincinnati, Ohio.
Richard M. Carson, G. H. R. Foundry Div., Dayton Malleable Iron Co., Dayton, Ohio.
John Kemp, Salesman, Hickman, Williams & Co., Cincinnati, Ohio.
Arthur K. Lucas, Foundry Supt., The Lancaster Foundry Corp., Lancaster, Ohio.

DETROIT CHAPTER

William H. Dawson, Control Met., Ford Motor Co., Dearborn, Mich.
John B. Hartrick, Chemist, Pontiac Grey Iron Foundry, Pontiac, Mich.
Edgar W. Jones, Eng. Div. Rep. No. 461, Chrysler Corp., Detroit.

DETROIT CHAPTER—SAGINAW VALLEY GROUP

William Reid Bond, Foundry Foreman, Saginaw Malleable Iron Div., G.M.C., Saginaw, Mich.
D. L. Boyes, Sales Mgr., Saginaw Malleable Iron Div., G.M.C., Saginaw, Michigan.
Elmer E. Braun, Chief Inspector, Saginaw Malleable Iron Div., G. M. C., Saginaw, Mich.
Alfred J. Brisbois, Purchasing Agent, Saginaw Malleable Iron Div., G.M.C., Saginaw, Mich.
Arthur M. Clark, Customer Contact, Saginaw Malleable Iron Div., G.M.C., Saginaw, Mich.
Robert H. Greenlee, Jr., Met., Saginaw Malleable Iron Div., G.M.C., Saginaw, Mich.
Stanley A. Meade, Laboratory Technician, Chevrolet Grey Iron, Saginaw, Michigan.
John C. Mulholland, Saginaw Malleable Iron Div., G.M.C., Saginaw, Michigan.
John Peterson, Foundry Foreman, Saginaw Malleable Iron Div., G.M.C., Saginaw.
Walter A. Szott, Chief Draftsman, Saginaw Malleable Iron Div., G. M.C., Saginaw.
Robert H. Zoller, Melting Supt., Saginaw Malleable Iron Div., G.M.C., Saginaw.

EASTERN CANADA and NEWFOUNDLAND CHAPTER

Roland Beaulieu, Warden King Ltd., Montreal, Que., Canada.
Watson Bellows, Warden King, Ltd., Montreal, Que., Canada.
Philippe Descarrier, Warden King, Ltd. Montreal, Que., Canada.

METROPOLITAN CHAPTER

David Malikin, Shop Planner, Brooklyn Navy Yard Foundry, Brooklyn, N. Y.
Ernani J. Werneck Pereira, Engr., Brazilian Gov't Airplane Engine Factory Commission, New York City.
Wm. H. Sparrow, Metallurgist, Sperry-Gyroscope, Inc., Brooklyn, N. Y.

*Company Member

MICHIANA CHAPTER

Gordon Atherton, Foundry Supt. Premier Furnace Co., Dowagiac, Mich.
***Premier Furnace Co., Dowagiac, Mich. (I. S. Peterson, Works Mgr.)**
Rexford Staley, Foreman, Premier Furnace Co., Dowagiac, Mich.
P. E. Thompson, Chief Accountant, Premier Furnace Co., Dowagiac, Michigan.

NORTHEASTERN OHIO CHAPTER

C. W. Hunt, National Gypsum Co., Luckey, Ohio.
Ralph L. Nock, Refractory & Furnace Engr., The Nock Fire Brick Co., Cleveland.
Arthur Tumpach, Metallurgist, Ferro Machine & Foundry Co., Cleveland.

NORTHERN CALIFORNIA CHAPTER

John R. Reynolds Steel Melting Foreman, General Metals Corp., Oakland, Calif.
***Ridge Foundry, San Leandro, Calif. (J. D. Crain)**

PHILADELPHIA CHAPTER

E. J. Basch, Research, Doehler Die Casting Co., Pottstown, Pa.
***Camden Foundry Co., Camden, N. J. (John W. March, Pres.)**
Le Roy Hill Swan, Jr., Sand Control & Research Tech., Dodge Steel Co., Philadelphia.

QUAD-CITY CHAPTER

Earl R. Goin, Foreman, Frank Foundries Corp., Moline, Ill.
***Iowa Steel & Iron Works, Cedar Rapids, Iowa (Adam W. Pietz, V.P. & Foundry Mgr.)**
Henry J. Loufek, Met., Iowa Steel & Iron Works, Cedar Rapids, Iowa.

ST. LOUIS DISTRICT CHAPTER

Paul G. Snelson, Foreman, Fulton Iron Works, St. Louis, Mo.

SOUTHERN CALIFORNIA CHAPTER

***Adel Precision Products Corp., Burbank, Calif. (J. Lynn Reynolds, Chief Met.)**
Frank Burke, Asst. Core Room Foreman, Warman Steel Casting Co., Los Angeles.
Dave Johnson, Los Angeles.
B. L. Murman, Asst. Mgr., Wilson & Geo. Meyer & Co., Los Angeles.
Leonard L. Newby, Advance Aluminum & Brass Co., Los Angeles.
***Wilson & Geo. Meyer & Co., Los Angeles (T. H. Lathe, Mgr.)**

TWIN-CITY CHAPTER

Frank J. Berchem, Foreman, Northern Malleable Iron Co., St. Paul, Minnesota.
Fred J. Boxmeyer, Met., Northern Malleable Iron Co., St. Paul, Minn.
Arthur W. Johnson, Foreman, Northern Malleable Iron Co., St. Paul, Minnesota.
Walter E. Wahman, Foreman, Northern Malleable Iron Co., St. Paul, Minnesota.

WESTERN MICHIGAN CHAPTER

James H. Armstrong, Metallographic Analyst, Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.
Armour J. Hill, Plant Supt., Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.
George J. Johnson, Fdry. Supv., Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.
Albert R. Kluge, Foundry Supt., Fuller Mfg. Co., Kalamazoo, Mich.
Weldon H. Long, Industrial, Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.
John J. Miclot, Industrial Engr., Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.
J. D. Miller, Training Dir., Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.
Joseph S. Mogdis, Supv., Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.

John Byron Powers, Metallographer, Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.
Harold B. Westbrook, Fdry. Supv., Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.

WESTERN NEW YORK CHAPTER

William Cawthra, Foreman, Acme Pattern & Machine Co., Inc., Buffalo, New York.

WISCONSIN CHAPTER

Raymond A. Beecher, Foundry Foreman, International Harvester Co., Milwaukee.

OUTSIDE OF CHAPTER

Robert Baxter, Met., Rolls-Royce Ltd., Glasgow S.W. 2. Scotland.
*Enfield Rolling Mills (Aluminum) Ltd., Brimsdown, Enfield, Middlesex, England. (Otto Metzger, Gen. Mgr.)
A. L. Flew, Holden & Lewis Pty. Ltd., Yarraville, Victoria, Australia.
Maurice R. Hinchcliffe, Tech. Asst. to Foundry Mgr., Rolls-Royce Ltd., Glasgow, S.W. 2, Scotland.
*Wiles Mfg. Co., Ltd., Adelaide, South Australia (J. Kenneth Wiles)
D. H. Wood, Managing Dir., The Constructional Engineering Co., Ltd., Birmingham 12, England.

X-RAY INSPECTION
Detects Faulty Repair Job

This brief article describes an unsuccessful attempt to salvage a steel casting by welding. It is interesting because it illustrates the fact that all defective castings are not the result of foundry technique . . . that welding in some instances is unsatisfactory . . . that final examination of a repair weld is desirable . . . and, finally, that X-ray equipment can be used for more than routine examination.

By HERBERT F. SCOBIE
University of Minnesota
Minneapolis

WHEN a defect in a casting or weld is discovered, it often is repaired and the part salvaged. The desirability of making a satisfactory repair and subjecting the repaired area to examination cannot be overemphasized. It is necessary to ascertain whether the entire defective area has been repaired and whether the repair operation itself has been properly performed. This is especially important in ordnance material subject to stress reversal and rapidly repeated impact.

The necessity of inspecting salvaged parts and the facility with which it may be done by means of X-rays is illustrated by the following incident:

Rejected Casting

A steel casting, an important component of a gun mount, was tentatively rejected after expensive machining. After the final drilling operation, small irregular cavities were noticed in the walls of three drilled holes. Since the holes were drilled in unfed bosses, it might have been assumed that solidification shrinkage had caused the voids. However, the cavities appeared in two parallel lines running the length of each hole and in the same relative positions.

A radiograph of the questionable area is shown in the illustration, reduced 50 per cent in size. The three double circles show where the holes were drilled off-center, then very poorly welded, after which the holes were drilled in the correct location. The almost total lack of fusion between the weld metal and the casting is shown by the irregular dark outline of the plug weld. The properly located drilled holes were filled with a radio-opaque putty to prevent film fogging and loss of detail in the radiograph. The small circles in the putty are due to lead shot which had accidentally become mixed with the putty.

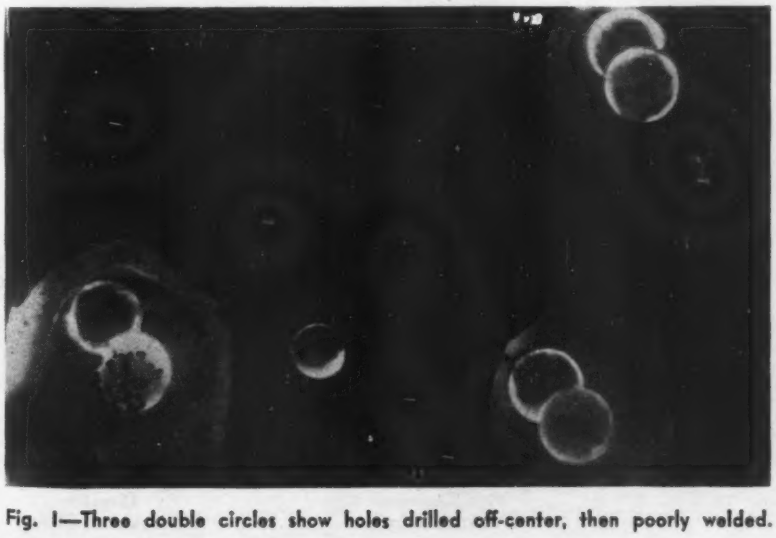


Fig. 1—Three double circles show holes drilled off-center, then poorly welded.

Welding Not Visible

That the holes had been welded was not evident from visual inspection of the surface, because the casting had been painted and the bosses counterbored subsequent to welding. Etching with ammonium persulfate solution made the plug weld and the fusion zone visible.

The intersection of the drilled holes with the welded holes enabled the inspector to see the double row of voids aligned longitudinally in the three drilled holes. This resulted in tentative rejection of the part.

After radiographic examination, the part was unconditionally scrapped!

J. R. Allan to Serve on Postwar Safety Committee

JAS. R. ALLAN, International Harvester Co., Chicago, has been appointed by C. R. Cox, Chairman, Postwar Industrial Safety Committee, National Safety Council, Chicago, to serve on that committee as the representative of the American Foundrymen's Association.

Mr. Allan's appointment was made at the suggestion of National President Ralph J. Teetor, Cadillac Malleable Iron Co., Cadillac, Mich., in recognition for his leadership in promoting safety practices in foundry work. At present Mr. Allan is Chairman of the A.F.A. Industrial Hygiene Codes Committee.

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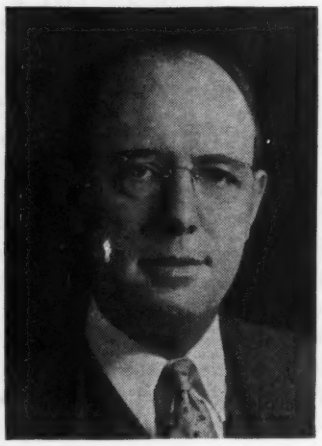

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Anthes-Imperial Ltd., St. Catharines, Ontario
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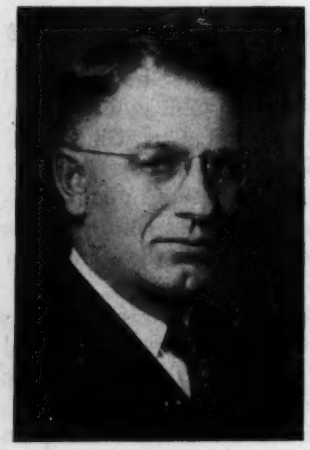

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Thomas Foundries, Inc., Birmingham
Director
Birmingham Chapter

CHAPTER ACTIVITIES News

See page 25 for list of Chapter representatives whose reports of local activities appear in this issue.

RECONVERSION PROGRAM

Discussed by NEO Group at Meeting

By Edwin Bremer

MEMBERS of the Northeastern Ohio Chapter got off to a flying start with their opening meeting held at the Cleveland Club on September 14. Approximately 100 members and guests were present. President Russell F. Lincoln, Russell F. Lincoln Co., Cleveland, presided, and, in extending his welcome, he pointed out that the coming year will be an important one. He said that the foundry industry has been little understood, as evidenced by unfavorable publicity, and urged every foundryman to participate in an organized effort to spread the true facts.

Mr. Lincoln also said that, in order for the chapter to provide the utmost in real and effective help in the future reconversion program, every member must be active. Following an introduction of the new officers of the chapter, Mr. Lincoln called on Jack Hornug to take a bow in recognition of his retirement from the industry after 61 years of service with Ohio Foundry Co.

Main speaker of the evening was James L. Bates, director of technical division, U. S. Maritime Commission, Washington, who described some of the activity of that organization in providing shipping capacity. Under its supervision over 38,000,000 tons of deadweight ships were built in less than 3 years. This comprised 3,751 ships of various types, including 2,316 Liberty type. These vessels carried 62,000,000 tons of goods, of which nearly 25 per cent was petroleum products.

The evening's program was concluded with the showing of a motion picture produced for General Motors Corp. and depicting the role of American industry in the war.

1944-45 Season Begins for Birmingham Chapter

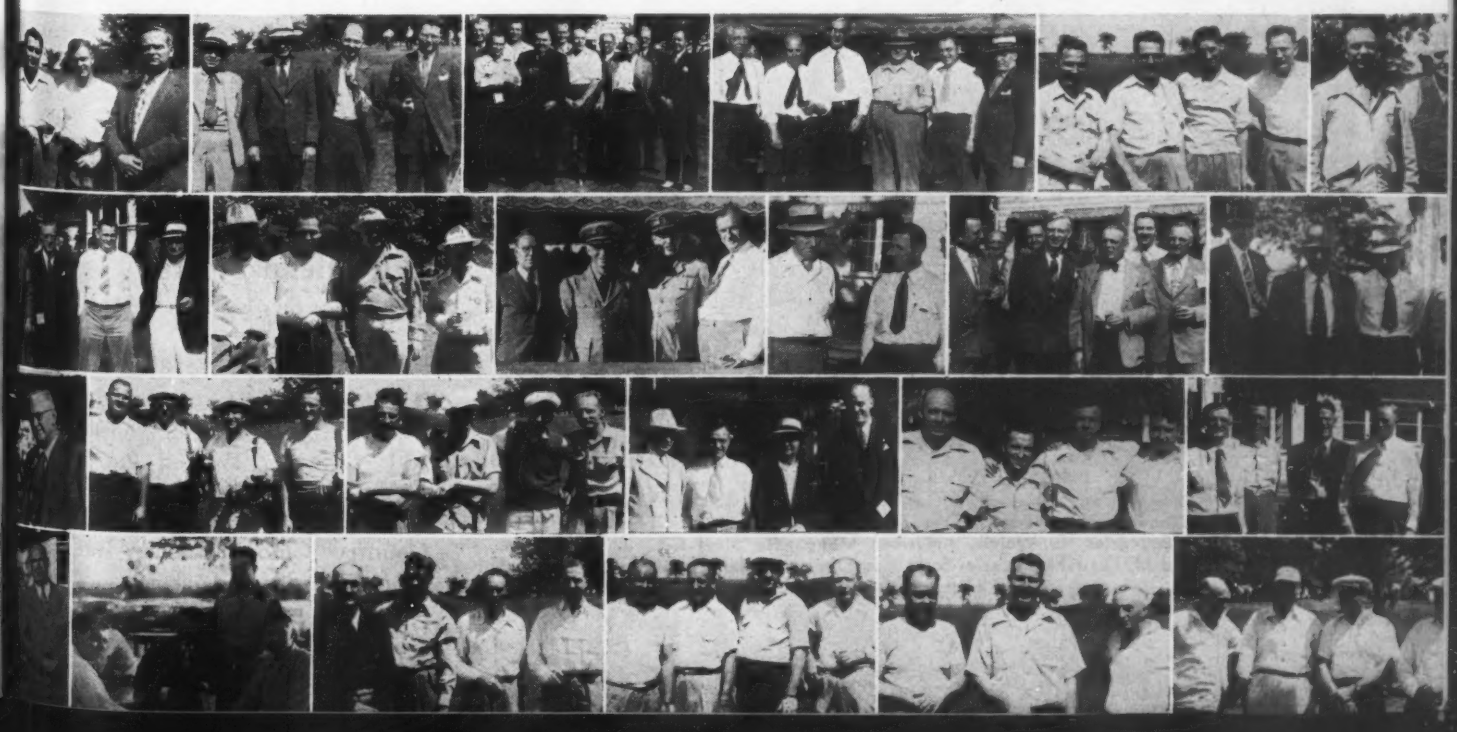
H. B. McLaurine

THE Birmingham District Chapter's 11th Annual Outing, held September 9 at the Birmingham Country Club, was the opening event on the 1944-45 calendar. Approximately 500 members and guests were on hand to enjoy the swimming, golf, horseshoe pitching, baseball and other sports events listed on the diversified program.

A dinner of barbecued pork and beef began the evening festivites.

The weatherman cooperated in making sure that the Wisconsin Chapter's 13th Outing was a success.

(Photos courtesy John Bing, A. P. Green Fire Brick Co.)



Prizes of war bonds and stamps were awarded to winners in the various contests, and all ticket holders participated in the drawings for door prizes.

Credit for a most successful outing goes to Tom Benners, Woodward Iron Co., chairman of the entertainment committee. Gale Irvin, Republic Steel Corp., was in charge of ticket distribution, while the direction of the different sports events was under the supervision of Harry Mouat, Whiting Corp., and Gene Whelchel, American Cast Iron Pipe Co., L. G. Ogden, American Casting Co., as Sergeant-at-Arms, was on the alert to keep the routine running smoothly and make certain that everyone had a good time.

H. W. Dietert Talks At Quad City Opening

By H. L. Creps

SIXTY-FIVE members and guests met at the Fort Armstrong Hotel, Rock Island, Ill., September 18, for the opening meeting of the Quad City Chapter. R. E. Wilke, Deere & Co., Moline, the chapter chairman, presided.

Mr. Wilke, after reporting briefly on the Chapter Contact Conference and the organization of new national committees, introduced the speaker of the evening, H. W. Dietert, Harry W. Dietert Co., Detroit.

In discussing "Mold Gases and Mold Atmosphere Control," Mr. Dietert showed a colored motion picture, illustrating the penetration of various metals in the core during pouring operations and while the castings are cooling. The picture also illustrated the affects of different atmosphere, and it was pointed out that an atmosphere consisting of nitrogen or natural gas was the most desirable for the prevention of penetration.

Mr. Dietert also discussed the various types of facing materials. He prophesied more concentrated and purer facing materials in the future.

On August 19 the Chicago Chapter met at the Lincolnshire Country Club, Crete, Ill., for the group's annual outing. Prize winners in the golf contests were (1) L. Skortman, American Steel Foundries; E. Wojcik, American Manganese Steel Co.; J. C. Hanson, Carnegie, Ill.; and H. Lundahl, Imperial Brass Co. Dinner "under the big tent" climaxed a day of fun and relaxation.

Outing Climaxes Season for Southern California

By R. H. Hughes

THE entertainment committee, headed by Bill Emmett, Los Angeles Steel Casting Co., spared no effort to make Southern California's 7th Annual Stag, held August 5, an outstanding success.

A full program of sports and games made the time seem all too short, while the dinner an ensuing entertainment rounded out a day of fun and good fellowship that will long be remembered.

H. R. McCoy Opens Season for St. Louis

By Chas. E. Rothweiler

A FINE turnout gathered at the DeSoto Hotel, St. Louis, on September 14 for the St. Louis Chapter's first meeting of the season.

Principal speaker of the occasion was H. R. McCoy, Ohio Steel Foundry Co., Lima, Ohio. In his talk, "Basic Principle Followed in the Development and Production of Cast Steel Breech Rings," Mr. McCoy provided a subject that aroused keen interest.

200 Attend Picnic Given by Michiana

By C. W. Petersen

W. V. JOHNSON, Oliver Farm Equipment Co., South Bend, Ind., was in charge of the annual picnic held by the Michiana Chapter, September 16, at the Christiana Country Club, Elkhart, Ind. To him and his co-workers goes real

credit for planning a day that marked one of the most successful outings in the history of the chapter.

Bait casting again crowded the spotlight of popularity among the 200 present, but golf, softball and a variety of other sports and games had enthusiastic partisans. Prizes for the numerous contests were awarded during the dinner hour, which was followed by an entertaining floor show.

Record Attendance At Ontario Outing

By G. L. White

TWO hundred and five members and guests turned out at "Barnesdale" for the annual picnic of the Ontario Chapter on Saturday, August 26. The weather favored the event and, as a result, not only the attendance but the participation in all the games and events reached new heights.

Owing to the crowded condition of available golf courses, it was necessary for the golfers to start their game at Dundas Golf Club in the morning. This, however, proved to be an excellent innovation, since it enabled the whole crowd to assemble at "Barnesdale" by the middle of the afternoon. There the usual A.F.A. sports program was run off, with horseshoe pitching, shooting and darts, volley ball, and other special games.

Everyone voted the picnic an outstanding success, and the thanks of the Chapter was expressed to Russell Woods, Cavin Young and Rolph Barnes, who carried out most of the arrangements, and again to Rolph Barnes for the use of his estate, and to all the firms that contributed so generously to the picnic.

Reports on Chapter Activities

Officers and representatives of A.F.A. chapter and other foundry groups who report on local activities in this issue, are identified below:

Northeastern Ohio—Edwin Bremer, THE FOUNDRY, Cleveland; Chapter Reporter.

Birmingham—H. B. McLaurine, Birmingham, Ala.; Chapter Reporter.

Quad City—H. L. Creps, Frank Foundries Corp., Moline; Chapter Secretary-Treasurer.

Southern California—R. H. Hughes, Almquist Bros. & Viets, Los Angeles; Chapter Publicity Chairman.

St. Louis—C. E. Rothweiler, Hickman, Williams & Co., St. Louis; Chapter Secretary-Treasurer.

Michiana—C. W. Petersen, Dodge Manufacturing Corp., Mishawaka, Ind.; Chapter Reporter.

Ontario—G. L. White, Westman Publications, Ltd., Toronto; Chapter Secretary-Treasurer.

Northern Illinois-Southern Wisconsin—H. W. Miner, Fairbanks, Morse & Co., Beloit, Wis.; Chapter Secretary.

Northern California—Richard Vosbrink, Berkeley Pattern Works, Berkeley; Chapter Reporter.

New England Foundrymen's Assn.—Merton A. Hosmer, Hunt-Spiller Mfg. Corp., Boston; Group Reporter.

Combination Meeting Held by No. Ill.-So. Wis.

By H. W. Miner

A COMBINATION social and business meeting was held by the Northern Illinois and Southern Wisconsin Group, September 12, at the Faust Hotel, Rockford, Ill. Sixty-six members and guests attended the dinner, which was preceded by a cocktail hour.

Following a short business session,

More than 500 members and guests of the Southern California Chapter temporarily forgot war production problems, August 5, when the 7th Annual Summer Stag was held at the Lakewood Country Club, Long Beach, Calif.

(Photos courtesy American Foundry Equipment Co.)

Good weather coupled with good fellowship proved the right combination to make the Michiana Outing, held at the Christiana Country Club, Elkhart, Ind., on September 16, a day that will long be remembered by the 200 Chapter members and guests in attendance.

two motion picture—"Men of Fire," which depicts the foundry's role in the war, and "Whistling Wings," a duck hunting study—climaxed the program.

No. Calif. Continues Apprentice Training

By Richard Vosbrink

ON SEPTEMBER 1, Ralph C. Noah, San Francisco Iron Foundry, San Francisco, took over the helm as president of the Northern California Chapter. This first meeting of the current term, held at the Engineers' Club, San Francisco, attracted an attendance of 101 members and guests, representatives from 53 different firms.

After Mr. Noah gave a brief summary of his recent trip to Chicago for the purpose of attending the National Chapter Contact Conference, and reported local items of interest, Harold Henderson, Chairman of the Sand Committee, presented an outline of future committee plans.

National Director S. D. Russell, Phoenix Iron Works, Oakland, Calif., then gave an outline of A.F.A. activities and reported on the progress of the Chapter's Apprentice Training Committee. His remarks were augmened by those of J. L. Melling, H. C. Macaulay Foundry Co., who is serving the committee as instructor of the apprentice classes.

David B. Reeder, Electro Metallurgical Sales Corp., was the featured speaker of the evening. His talk, "The Melting and Treatment of Cast Iron," gave a detailed presentation of cupola operation. By sketching outlines on a blackboard, the speaker gave a complete explanation of the process and the technique he advocates.

Those in the audience who were familiar with the process had an excellent opportunity to review their knowledge; for the others, the talk provided a down-to-earth discussion on a popular foundry subject.

Season Begins for New England Group

By Merton A. Hosmer

CHARLES BURKART, Framingham Foundries, Inc., Framingham, Mass., was the speaker at the September 13 meeting of the New England Foundrymen's Association, held at the Engineers' Club, Boston.

In presenting his subject, "Modern Cupola Melting," Mr. Burkhart outlined a melting practice with particular reference to the use of steel in the cupola. His talk provoked a lively discussion period.

Statement of Ownership

Statement of the ownership, management, circulation, etc., required by the acts of Congress of August 24, 1912, and March 3, 1933, of *American Foundryman*, American Foundrymen's Association, published monthly at Chicago, Ill., for October 1, 1944, State of Illinois, County of Cook, ss. Before me, a notary public in and for the state and county aforesaid, personally appeared R. E. Kennedy, who, having been duly sworn according to law, deposes and says that he is the Editor of the *American Foundryman*, American Foundrymen's Association, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, to-wit: 1—That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, American Foundrymen's Association, Inc., Chicago, Ill.; Editor, R. E. Kennedy, Chicago, Ill.; Managing Editor, N. F. Hindle, Chicago, Ill.; Business Managers, None. 2—That the owner is American Foundrymen's Association, Inc., not for profit; stock, none. Principal Officers: R. J. Teetor, President, Cadillac Malleable Iron Co., Cadillac, Mich.; R. E. Kennedy, Secretary, Chicago, Ill. 3—That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None. 4—That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him. R. E. Kennedy, editor. Sworn to and subscribed before me this 8th day of Sept. 1944. (Seal) Jennie Reininga, Notary Public. (My commission expires Feb. 9, 1946.)

Abstracts

NOTE: The following references to articles dealing with the many phases of the foundry industry, have been prepared by the staff of *American Foundryman*, from current technical and trade publications.

When copies of the complete articles are desired, photostat copies may be obtained from the Engineering Societies Library, 29 W. 39th Street, New York, N. Y.

Aluminum

AIRCRAFT PARTS. *"Messerschmitt Header Tank,"* FOUNDRY TRADE JOURNAL, vol. 73, no. 1458, pp. 255-257.

A description of the materials and methods of construction used in a header tank taken from a Messerschmitt 109. A study of the part included chemical analysis, hardness tests, and microscopic examination.

Bonding Processes

STEEL-ALUMINUM. *"New Process Bonds Aluminum Cooling Fins to Steel Cylinder Barrels,"* INDUSTRIAL HEATING, vol. 11, no. 8, August, 1944, pp. 1270, 1272.

This article discusses the application of a process for permanently bonding pure aluminum and steel into an integral part to aircraft cylinders. Aluminum fins are bonded to steel cylinder barrels. The aluminum fins dissipate heat more rapidly than steel, while the steel in the cylinder barrels has greater strength than aluminum. The use of this combination has resulted in obtaining greater horsepower-to-weight ratios in aircraft engines.

Cast Iron

CORROSION RESISTANT. *"Acid-Resisting Metal,* IRON AND STEEL, vol. 17, no. 13, August, 1944, p. 563.

A description of the corrosion resistance of a commercial high silicon iron in the presence of corrosive acids.

Casting Methods

CENTRIFUGAL. *(See Centrifugal Casting.)*

CONTINUOUS. *"Continuous Casting,"* V. Kondic, METAL INDUSTRY, vol. 65, no. 4, July 28, 1944, pp. 56-58.

Continuous casting refers to a process in which the casting is continuously withdrawn from a mold while the metal is being cast.

The most important characteristic of all machines used for continuous casting is the rapid removal of heat from the molten metal in order to effect rapid solidification. Heat removal is dependent upon the total amount of heat to be abstracted, the thermal conductivity of the mold and the cast metal, and the thermal diffusivity of the cast metal.

The author has discussed the problems of heat transfer, as well as the metallurgical factors of the continuous casting process. Metallurgical factors may be divided into two groups: the effects of casting properties of the metal on the design of the casting unit, and the effect of the method and speed of cooling on the properties and quality of the cast metal.

Centrifugal Casting

SPEED OF ROTATION. *"Centrifugal Casting,"* J. E. Hurst, IRON AND STEEL, vol. 17, no. 12, July, 1944, pp. 533-536.

The author discusses the rotational speeds used in commercial centrifugal casting, both for vertical or horizontal axes or combinations of these.

STEEL. *"Steel Castings—Centrifugally Cast,"* James W. Moore, METALS AND ALLOYS, vol. 20, no. 2, August, 1944, pp. 365-368.

The author describes three methods of casting: true centrifugal, semi-centrifugal, and centrifuging. He compares centrifugal with static casting methods, discusses the factors which govern the choice of casting method, and compares centrifugally cast parts with forged parts.

Cleaning

FERROUS METALS. *(See Pickling.)*

Copper-Base Alloys

ANALYSIS. *(See Spectrographic Analysis.)*

TIN-BRONZE. *"Properties of Tin-Bronze,"* W. T. Pell-Walpole and V. Kondic, METAL INDUSTRY, vol. 65, no. 6, August 11, 1944, pp. 85-87.

The amount and kind of porosity present and the distribution of the eutectoid are largely responsible for the properties of a chill-cast degassed bronze. This paper suggests that proper pouring practice will eliminate many of the most harmful types of porosity.

Corrosion

PROTECTION. *"Corrosion Protection of Metals,"* K. G. Compton, CANADIAN METALS AND METALLURGICAL INDUSTRIES, vol. 7, no. 7, July, 1944, pp. 27-28, 53.

The author discusses various types of protective coatings, the mechanism of corrosion, the protection of steel and aluminum alloys, and marine corrosion.

Customer Relations

CASTINGS. *"Some Aspects of Technical Service Applied to the Iron Foundry,"* H. Jackson, FOUNDRY TRADE JOURNAL, vol. 73, no. 1457, July 20, 1944, pp. 239-240.

A suggested means for increasing the understanding between the producer and consumer and for improving the quality of products.

Furnaces

DESIGN. *"Recent Development in Industrial Furnaces,"* H. C. Hottel, THE IRON AGE, vol. 154, no. 9, August 31, 1944, pp. 30-32.

A discussion of recent developments and trends in industrial furnace design. Subjects discussed include heat transfer, energy balance, mechanics, materials of construction, chemical process control, and combustion.

ELECTRIC. *"Arc Furnaces,"* C. C. Levy, IRON AND STEEL, vol. 17, no. 13, August 19, 1944, pp. 572-575, 580.

A discussion of power regulators and controls for electric arc furnaces.

PERMEABLE REFRACTORIES. *'Gas-Fired Furnaces,"* IRON AND STEEL, vol. 17, no 12, July, 1944, p. 546.

A new principle in gas-fired furnaces is the use of permeable refractories through which the products of combustion are withdrawn, thus eliminating the need for a flue. Preliminary work indicates that such a furnace would effect savings by reducing the heat which escapes from the flue and the heat which is conducted through the furnace walls.

So far the furnace has proved satisfactory only for temperatures between 500 and 1300° C. because of refractory limitations. This is the first time that a really new principle in furnace construction has been discovered in several years.

USES. *"Guide to Furnace Selection,"* D. H. Gardner, THE IRON AGE, vol. 154, no. 5, August 3, 1944, pp. 60-64, 138.

This article is exactly what the title states, a guide to furnace selection. The author discusses the major factors which should be considered when selecting a furnace for a particular job: (1) what the furnace has to do; (2) what production schedule must be met, and (3) whether special atmosphere or liquid heating media will do the job best.

Heat Treating

CAST STRUCTURES. *(See Steel.)*

QUENCHING. *"Incomplete Quenches,"* METAL PROGRESS, vol. 46, no. 2, August, 1944, pp. 308-312, 314.

This paper consists of talks given on various quenching practices. Included in the talks are "Timed Quenching," by Muir L. Frey; "Martempering," by Benjamin F. Shepherd, and "Hot Quenching and Austempering," by H. J. Elmendorf.

STEEL. *"Application of S-Curve Data to Heat Treating Problems,"* R. L. Cunningham and Arthur Dube, CANADIAN METALS AND METALLURGICAL INDUSTRIES, vol. 7, no. 7, July, 1944, pp. 22-26.

S-curves give a reliable picture of what happens when a steel is cooled from the austenitic state. The heat treater who understands S-curves can use austempering or martempering to develop desired combinations of hardness and toughness or to reduce cooling stresses to a minimum. However, he must keep in mind that the position of the S-curve for any steel is changed by variations in grain size, composition, or carbide solution.

The important thing to remember about S-curves is that each curve is drawn for a particular steel under specific conditions. Any change in these conditions must be taken into account when the curve is used as a basis for heat treatment.

Heat Treatment

PLAIN CARBON STEEL. *"A Microstructural Guide to the Heat Treatment of a Plain Carbon Steel,"* R. J. Raudebaugh and W. E. Fontaine, METALS AND ALLOYS, vol. 20, no. 2, August, 1944, pp. 359-364.

A series of charts and photomicrographs accompany a brief discussion of the various structures which may be obtained in a plain carbon (0.40 per cent C) steel by means of different heat treatments.

Impregnation

MAGNESIUM CASTINGS. *"Plastic Impregnation of Magnesium Castings,"* THE IRON AGE, vol. 154, no. 6, August 10, 1944, p. 63.

This article describes a new plastic impregnant which is said to be superior to tung oil for this purpose. The method of impregnating castings is also described.

Inspection

MAGNETIC. *(See Non-Destructive Testing.)*

Magnesium-Base Alloys

MELTING PRACTICE. *"The Melting and Refining of Magnesium,"* C. E. Nelson, Technical Publication 1708, METALS TECHNOLOGY, vol. 11, no. 5, August, 1944, 13 pages.

A discussion of the various methods of melting and refining magnesium. The author places great emphasis on the importance of proper fluxing, regardless of what method of melting is used. In this country fluxes have been developed which are adequate for all melting methods. It is not of the greatest importance that the original purity of the magnesium ingot or crystal be maintained during melting, since the alloying metals which are added carry a greater amount of impurities.

A method has been developed whereby any excess of iron may be precipitated from the melt.

RECLAMATION. *(See Impregnation.)*

Metallography

MAGNESIUM ALLOYS. *"A Numerical Rating Method for the Routine Metallographic Examination of Commercial Magnesium Alloys,"* P. F. George, A.S.T.M. BULLETIN, no. 129, August, 1944, pp. 35-44.

The author has presented a method of routine examination of magnesium alloys which should enable inexperienced persons to describe a microstructure. Among the subjects covered are specimen preparation, etching technique, and a numerical system for rating microstructures.

POLISHING. *"Rapid Hand Polishing of Micro Specimens,"* Anton L. Schaeffler, METAL PROGRESS, vol. 46, no. 2, August, 1944, pp. 285-287.

The author describes a rapid method of hand-polishing micro specimens. The steps included in this method are: rough polishing on three grades of emery paper, wax lap, and final polishing on a cloth wheel, using an abrasive whose principal ingredient is gamma alumina.

Non-Destructive Testing

MAGNETIC. *"Organic Coating Aids Magnetic Inspection,"* Gilbert C. Close, THE IRON AGE, vol. 154, no. 9, August 31, 1944, p. 41.

The author describes a new organic primer-surfacer to replace the cadmium flash coat which was formerly used on parts to render magnetic indications more readily detectable. The new material is applied with a spray gun and allowed to dry before immersion in the petroleum solution. It is not necessary to remove the primer-surfacer if subsequent coating is also organic.

Pickling

FERROUS METALS. *"Pickling,"* Frank Taylor, IRON AND STEEL, vol. 17, no. 12, pp. 525-527.

Pickling is the removal of oxide films by chemical treatment in acid solutions. The author discusses the theory of pickling, pickling solutions, inhibitors, and various improvements on standard acid pickling baths.

A modern descaler should satisfy the following requirements: (1) descaling time should be reduced to a minimum; (2) at least partial regeneration of the pickling acid should be possible; (3) evolution of obnoxious fumes should be at a minimum; (4) the bath should contain an inhibitor which does not permit appreciable attack on the base metal, does not increase descaling time, minimizes the danger of hydrogen embrittlement, is stable at different temperatures and concentrations, is free-rinsing and stable in hard waters, and has a high inhibition efficiency; descaler should provide a good clean surface which will not oxidize readily; descaler should be free-rinsing in both hard and soft waters; and a stable wetting agent should be incorporated to accelerate descaling.

Protective Coatings

STEEL AND ALUMINUM. *(See Corrosion.)*

Refractories

PERMEABLE. *(See Furnaces.)*

SILICA BRICK. *"Determining the Quality of Silica Brick,"* Frank G. Norris, INDUSTRIAL HEATING, vol. 11, no. 8, August, 1944, pp. 1316, 1318.

Failure of furnace refractories is directly related to the amount of liquid phase present at operating temperatures. This, in turn, is related to composition.

SILICA FIRE CLAY. *"Some Factors Affecting the P.C.E. of Silica Clay,"* Raymond E. Birch and Morris P. Hall, THE JOURNAL OF THE AMERICAN CERAMIC SOCIETY, vol. 27, no. 8, August 1, 1944, pp. 239-241.

The author has discussed the factors which affect the pyrometric cone equivalent of silica fire clay. Among these factors are fineness of grind, mix proportions and quality of materials.

Safety and Hygiene

DUST REMOVAL. *"Dust Collecting Systems,"* F. C. Morey, IRON AND STEEL ENGINEER, vol. 21, no. 7, July, 1944, pp. 45-51.

A summary of recommendations in the design and operation of dust collecting systems for various types of equipment.

Spectrographic Analysis

COPPER-BASE ALLOYS. *"Quantitative Spectrographic Analysis of Copper Alloys,"* R. A. Wolfe and Emile J. Jemal, A.S.T.M. BULLETIN, no. 129, August, 1944, pp. 45-52.

A carefully controlled method of spectrographic analysis is applicable to copper-base alloys having high element concentrations. With proper sampling, the maximum error in the analysis of one element need not be more than ± 1.5 per cent of the amount of that element present.

Spectrographic Analysis

INSPECTION. *"The Spectrograph as an Inspection Tool,"* J. D. Graham and H. F. Kincaid, METALS AND ALLOYS, vol. 20, no. 2, August, 1944, pp. 355-358.

The authors discuss the principles of spectrographic analysis, types of spectrographs which are available on the market, flat-surface sampling technique, and accuracy of results.

Steel

CENTRIFUGALLY CAST. *(See Centrifugal Casting.)*

IMPACT TESTING. *"Variables Affecting the Results of Noth Notched-Bar Impact Tests on Steels,"* Clarence E. Jackson,

Myron A. Pugacz, and Frank S. McKenna, Technical Publication No. 1668, METALS TECHNOLOGY, vol. 11, no. 5, August, 1944, 17 pages.

A study of the effects of breadth of specimen, shape and size of notch, and testing temperature on impact test results, and the relation between energy absorption in the slow bend and impact tests, and between energy absorption and work hardening.

MECHANICAL PROPERTIES. *"Relationship of Brinell Hardness and Yield Stress in Certain Cast Steels,"* T. W. Ruffle, FOUNDRY TRADE JOURNAL, vol. 73, no. 1457, July 20, 1944, pp. 227-231.

After determining that there was a relationship between Brinell hardness and yield and ultimate strengths, the author developed empirical formulae by means of which the yield strength and ultimate strength can be estimated. The author emphasized, however, that these results apply only to the particular steel which he studied. For any other steel, it would be necessary to accumulate and study new data to determine a new relationship.

S-CURVES. *(See Heat Treating.)*

STRUCTURE. *"Cast Structures,"* H. T. Angus, IRON AND STEEL, vol. 17, no. 12, July, 1944, pp. 537-540.

This article describes the effects of various heat treatments, without hot or cold work, on the microstructure and mechanical properties of a hyper-eutectoid high silicon steel and a medium carbon steel casting.

TENSILE PROPERTIES. *"Tensile Properties of Medium-Carbon Low-Alloy Cast Steels,"* H. A. Schwartz and W. Kenneth Bock, Technical Publication No. 1719, METALS TECHNOLOGY, vol. 11, no. 5, August, 1944, 13 pages.

Test results presented in this paper indicate a linear relation between tensile strength and elongation for a given steel for various heat treatments. For the steels which the authors studied, the position and direction of the line can be calculated from the chemical composition. A similar relation exists between Brinell hardness and tensile strength. The authors feel that the relationships discussed will be of value in determining the steel composition most likely to give particular mechanical properties.

Zinc-Base Alloys

CAST DIES. *"Making Zinc Alloy Aircraft Forming Dies,"* Gerald E. Stedman, METALS AND ALLOYS, vol. 20, no. 1, July, 1944, pp. 83-88.

Manufacturers engaged in aircraft sheet metal forming have found it expedient to use temporary forming dies made from a zinc-base alloy until more permanent steel dies can be constructed. In this way they are able to keep in step with the quick succession of changes in aircraft part design.

How these dies are made and used is described in this article.

Schedule of October Chapter Meetings

October 2

Chicago
Chicago Bar Assn. Restaurant
J. D. GRUENER
International Harvester Co.
"Trends of Employee Relations"

✦

Metropolitan
Essex House, Newark, N. J.
L. P. ROBINSON
Werner G. Smith Co.
"Core Oil—Its Uses and Abuses"

✦ ✦

October 3

Michiana
Hotel Whitcomb, St. Joseph, Mich.
JOSEPH GITZEN
Delta Core Oil Co.
"Core Binders and Washers"

✦ ✦

October 5

Saginaw Valley Section, Detroit
Frankenmuth, Mich.
H. W. DIETERT
Harry W. Dietert Co.
"Mold Atmosphere Control"

✦ ✦

October 6

Rochester
University of Rochester,
River Campus
L. P. ROBINSON
Werner G. Smith Co.
"Variables in the Core Room—Their Treatment and Cure"

✦

Western New York
Hotel Touraine, Buffalo
FRED G. SEFING
International Nickle Co.
"Where Can Education Be Used in the Foundry?"

October 10

Northern Illinois-Southern Wisconsin
Hotel Hilton, Beloit, Wis.
W. B. GEORGE
R. Lavin and Sons
"Bronze and Brass"

✦ ✦

October 12

Northeastern Ohio
Cleveland Club
FRANK T. CHESTNUT
Ajax Electrothermic Corp.
W. B. WALLIS
Pittsburgh Lectromelt Furnace Co.
A. E. RHOADS
Kuhlman Electric Co.
"Electric Furnaces"

✦

Texas
Goldcrest Country Club, Houston
ROUND TABLE MEETING

✦ ✦

October 13

Philadelphia Chapter
Engineers Club of Philadelphia
N. J. DUNBECK
Eastern Clay Products, Inc.
"How to Select a Bond Clay"

✦ ✦

October 16

Quad City
Fort Armstrong Hotel,
Rock Island, Ill.
PETER BLACKWOOD
Ford Motor Co.
"Centrifugal Castings"

✦ ✦

October 19

Detroit
Rackham Educational Memorial,
Detroit
ROUND TABLE MEETING
"Gray Iron, Steel Aluminum"

October 20

Eastern Canada & Newfoundland
Mount Royal Hotel, Montreal
ROUND TABLE MEETING
"Iron, Bronze and Steel"

✦ ✦

October 25

Twin City
Midway Club, St. Paul
L. P. ROBINSON
Werner G. Smith Co.
"Variables Affecting the Baking of Cores"

✦ ✦

October 26

Canton District
Elks Club, Canton, Ohio
R. G. MCELWEE
Vanadium Corp. of America
"Economics of the Carbon Silicon Balance"

✦ ✦

October 27

Chesapeake
Engineers' Club, Baltimore
PETER BLACKWOOD
Ford Motor Co.
"Centrifugal Castings"

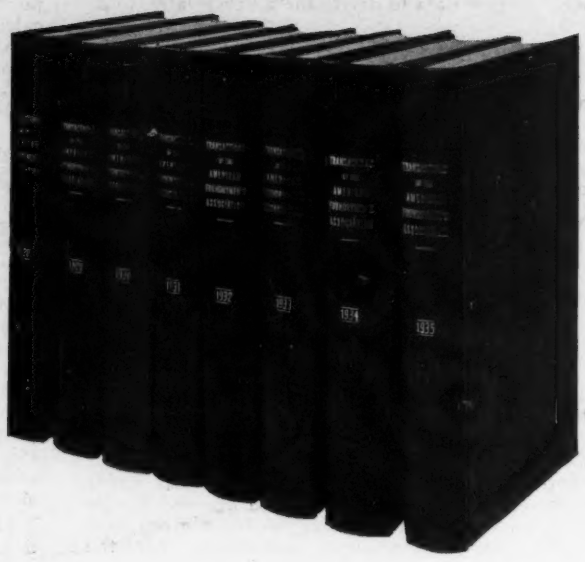
✦

Ontario
Royal York Hotel, Toronto
ROUND TABLE MEETING
Gray Iron, Non-Ferrous, Malleable, Steel
"Patterns and Pattern Equipment"

✦

Southern California
Los Angeles Elks Club
A. J. EDGAR AND W. W. ROSE
Gray Iron Founders' Society, Inc.

Volume 51



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